Pit and Quarry

With which is consolidated

CEMENT-MILL & QUARRY

March, 1933

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"I'm Afraid to Think . . ."

WORRYING is not thinking, although too many men are willing to accept the one as evidence of the other. The healthy, active, courageous mind does not worry, because worry is a disease, worry is stagnation, worry is mental cowardice. Worry is fear in its most insidious form. Worry is the refuge of the mind that is too sick, too feeble, or too lazy to think. Worry is the mask, the counterfeit semblance of intelligence, affected by the rambling mind. Worry is the false-face of a mediocre thinker.

How often do we hear men say, "I'm afraid to think . . ." or "I hate to think . . .," followed by a vivid picture of some imagined catastrophe! "I'm afraid to think what we'll do, if our price isn't low enough to get that order," says the typical business man. "I hate to think what'll happen if we can't declare our regular dividend," says another. "I can't bear the thought of closing that obsolete plant," wails a third. "I can't face the possibility of business declining still further," cries a fourth. "I can't stand the pressure of these times," comes from still another.

"I'm afraid" . . . "I hate to think" . . . "I can't bear the thought" . . . "I can't face" . . . "I can't stand." What a chorus of sobbing from men who have led us to believe that our destiny resides in them! What an admission of incapacity from men who want to be looked upon as the pinnacles of wisdom, the leaders of thought, the custodians of prosperity! What a dolorous form of harmony from the men who play with prices, quality, wages, unemployment, national welfare even, and whom the stupid multitude applauds with mouths agape and staring eyes!

Although all this passes for intelligence, it is sheer nonsense. Although offered as most sagacious comments, these are but the swan songs of moribund minds, of crippled mentality. Instead of winning the popular clamor with which they are received, they would be scoffed at and spurned by any people with only moderate powers of perception and discrimination. Instead of being tolerated as one of the many human frailties, they would be instantly condemned by anyone with but a glimmer of confidence in the possibilities of human progress.

These lamentations are unworthy of people who carried their heads so high during the soft days of prosperity. They are beneath the dignity of men who have stalked among us as the lords of creation. They are sad acknowledgments of the mental insufficiency, the moral limpness, of those who have claimed and received the rewards that should have gone to more capable and more courageous men.

Where is the bravery that walked so uprightly among us in 1929? Was it but a strutting arrogance? Where is the wisdom that advised so readily and so freely in 1929? Was it only brazen make-believe? Where is the confidence that could see not even real hazards in 1929? Was it boyish bragging? What we need now is the real qualities of which these were but the gaudy imitations. What we need now is real thinking, and not the ramblings of the worrying, hurrying, scurrying minds that hang their heads about us.

Pages 17-21

This Plant Is Taken To the Job!

Quarry at Turbotville, Pa.

Phone 101-R Watsontown

WEAVER STONE QUARRY

Fred M. Weaver, Prop.

Watsontown, Pa., Feb. 1st, 1933.

Mr. Edward Engel,
315 Orange St.,
Selinsgrove, Pa.

Dear Sir:-

We are pleased to answer the questions in your letter relating to the operation of the Gruendler 5XB Hammermill Crusher that was purchased from you early last year.

In regard to the Power required, we operate the entire plant very nicely with a 45 H.P. Steam Engine (Feeder - Elevator- Screen - Crusher).

We get an average of 30 tons per hour of 1" and under and when producing 2-1/2" it is better than 50 tons per hour, we feed stone 1/2 yd. sizes with a 3/4 yd. Shovel.

We are satisfied that we can produce at less cost per ton. In the first place we use less power per ton than could be used were we operating a primary and a secondary crusher of any two types that are on the market. The 5XB is doing the work of two crushers at not only less power but less initial cost and less maintainence. We also require no man to feed the crusher and we can keep a more uniform rate of material going thru the crusher due to the automatic feed, which is better adapted to the Hammermill crusher than to a Jaw or Gyratory.

Our stone is more cubical in shape, no flats, than we formerly made with two other type crushers.

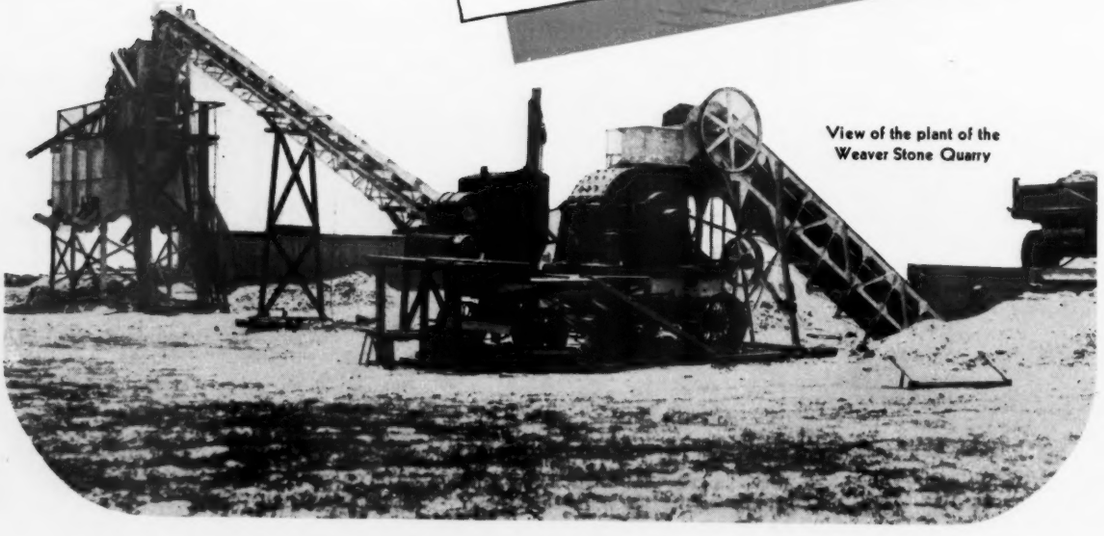
The only difference we see between this single unit operating as both a Primary and a Secondary at one and the same time- as compared with any other combination of other type crushers which we would require to get the equivalent tonnages- is that when crushing to make ballast sizes we get more chips. This is an asset at these times when 1" material is in demand, but as far as your question as to whether we get too much 5/8" and under it seems to me we actually get less.

From one season's operation we would state that on our rather hard and blocky limestone, and some of it is particularly hard, a set of hammer tips should last 50,000 tons. The other wearing parts show not the slightest of wear and should last four times or more longer.

You have been of quite some assistance to us, and if we are in a position at any time to be of service to you please command us.

Sincerely yours,

Fred M Weaver.



View of the plant of the Weaver Stone Quarry

• Get More Details •

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Model T-33
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I would like complete information and new specifications on the truck model checked below. I understand that this request places me under no obligation whatever. ☐ T-33 ☐ T-43

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Pit and Quarry

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CEMENT-MILL & QUARRY

Volume 25 March, 1933 Number 7

MEMBER AUDIT BUREAU OF CIRCULATIONS

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H. W. BAUMGARTNER
President

S. A. PHILLIPS
Vice-President and Directing Editor

Assistant Editors:
W. E. TRAUFFER
HARRY F. UTLEY

Advertising Representatives:

Chicago
W. A. BUSCHMAN
Telephone *HARrison 9357*
Chicago, Ill.

New York
E. M. BUCK, 700 Eighth Ave.
Telephone *Lackawanna 4-1400*

Cleveland
W. E. COATES, 1258 Marlowe Ave.
Telephone *LAkewood 1166J*
Lakewood, Ohio

San Francisco
C. C. ECKART, 703 Market St.
Telephone *GArfield 4964*

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BETTER BELTS BRING DOWN YOUR COSTS

GOODYEAR Conveyor Belts carry more tons, at lower cost per ton. They do so because they are built better and scientifically specified to their particular duty by the G.T.M.—Goodyear Technical Man.

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"G. T. M.-specified" means they are recommended by an expert on rubber after an on-the-ground study of the operating requirements they are called on to meet. They are accurately applied and carefully serviced.

Besides conveyor belts, Goodyear equipment for Sand and Gravel Plants includes such Goodyear-developed specialties as Goodyear Sand Suction Hose and Goodyear Dredging Sleeves; for Rock Products Industries, Cement and Stone Plants, Goodyear Elevator and Transmission Belts and Air Hose. It will probably save you money to talk over your needs with the G.T.M. To get in touch with him, drop a line to Goodyear, Akron, Ohio, or Los Angeles, California, or phone your nearest Goodyear Mechanical Rubber Goods Distributor.

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Perfect co-ordination applies to man and machine alike ... it is a basic law of nature ... without perfect co-ordination of muscle and mind no athlete becomes a champion . . . without it no machine performs efficiently.

In TRU-LAY PREFORMED WIRE ROPE, perfect co-ordination among strands is obtained by preforming wires and strands so they lie normally in position. Strands are freed from internal stress, and lying *relaxed* in their helical form, each strand carries an equal share of the load . . . in teamwork with each other strand.

Now consider what takes place in *non*-preformed wire rope. Strands and wires are forcibly held in place—against their will—which sets up fatigue stresses . . . and unbalanced strand loads. Common sense tells us that such a rope cannot possibly give the same amount of service as Preformed Wire Rope of the same size, grade and construction.

DO THIS

Cross your fingers. This is the way the strands of *non*-preformed fit together . . . under strain.

Note the pressure. Move your fingers . . . note the friction. This unnatural condition is the cause for premature fatigue and comparatively short life in *non*-preformed wire rope.

NOW DO THIS

Lap your index fingers like this . . . illustrating how the strands and wires in TRU-LAY wind about each other. Without pressure or strain. Without straightening out tendency.

No wonder TRU-LAY returns more dollar value in service and performance.

REMEMBER:

The usual result of unbiased tests of TRU-LAY Preformed versus *non*-preformed wire rope of the same size and grade—*average* comparative records over a period of time—on the same equipment and under identical working conditions—the results of many such tests are *overwhelmingly* in TRU-LAY'S favor.

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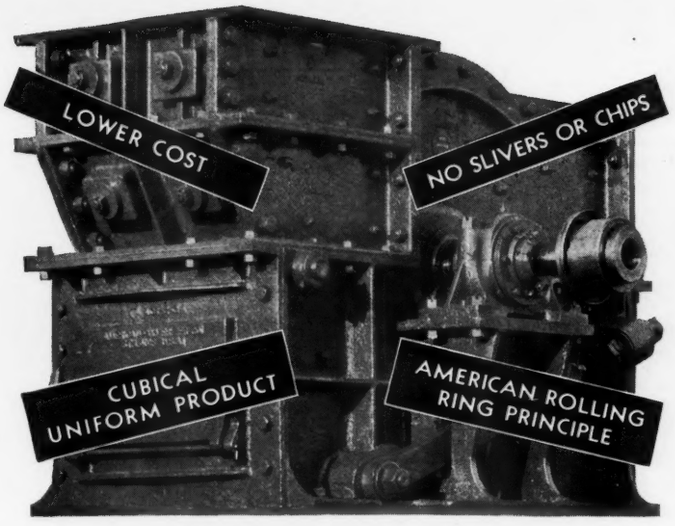

Even if you don't need one NOW

GET the FACTS on this CRUSHER

so you will be informed on new developments

WHETHER you will ever be in position to buy a new crusher is not the question. If you are interested in crushing stone and other refractory materials, you should know about the American rolling ring Crusher. We all face a new day. New values—new methods—new thinking. This crusher brings a new day of costs and performance.

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Why rolling rings have many times the wearing surface of a hammer. Why they last longer than hammer types. How you get uniform cubical products with no slivers or chips—minimum fines, and why American Crushers are easier to dismantle, move and reassemble than other crushers.

We will send you a simple yet thorough description of the American rolling ring Crusher. It will show you how the American Crusher can cut costs and increase your profits. It will explain in detail why the American rolling ring Crushing principle makes American Crushers outlast other types and why all parts are accessible and easily replaced in a short time. It will prove why lower costs are only a few of the features that make this new crusher the one meeting today's demands. What it costs, how it operates, how it can save money for you. Facts you want—all are clearly explained. Send for this information.

***Keep Posted*—Send for Complete Information**

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Please send me complete information about the new American Rolling Ring Crushers.

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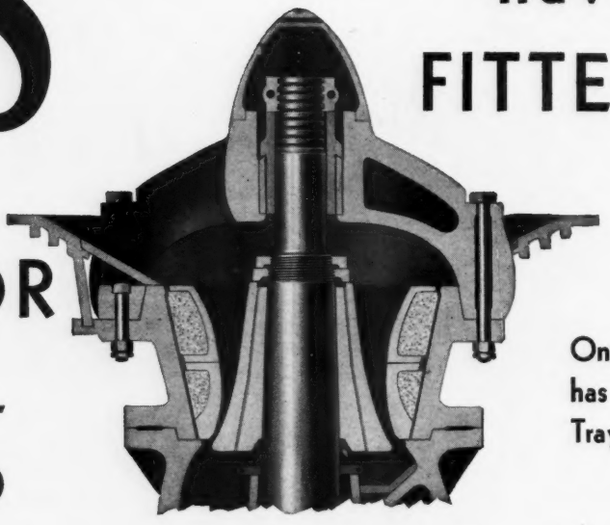

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One large Eastern producer has 14 Gyratories fitted with Traylor Bell Head & Concaves

BELL HEAD & CONCAVES

USERS MAKE BIG PROFITS

A No. 6 McCully formerly made 50 tons to 2"—now 101 tons to 1¾".

•

A No. 8 K Gates—old capacity 98 tons to 2¾"—now delivers 205 tons to 2½".

•

A 6" Traylor Bulldog—originally 25 tons to 1⅛"—now 48 tons to 1".

•

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•

No increase in speed or horsepower in any of these cases.

This great invention meets the operator's depression necessities, because it enables him to make out of any old, inefficient Gyratory a first-class reduction crusher which will double his output of small sizes at no increase in power consumed and at the same time enable him to secure service from the last ounce of the crusher fittings because the wear is uniform to almost a hair—no "gouging" of heads or wearing the tips off the bottom of the concaves. In other words, crushing at half cost, maintenance at one-third to one-fifth outlay.

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Gravel plant—"* * * The material that we crush is granite, trap rock and limestone boulders. We do not know the increased capacity of the No. 5 Gates, but we know that it had to give at least 50% increase to take care of our needs.* * *"

Gravel plant—"* * * We feel that the installation of this crusher will warrant the expense which we have gone to and would recommend its use to any one. * * *"

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This series of monographs which is being published by the Standard Oil Company (Indiana) will start in the April issue of this publication. Look for it.

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(Indiana) 1816

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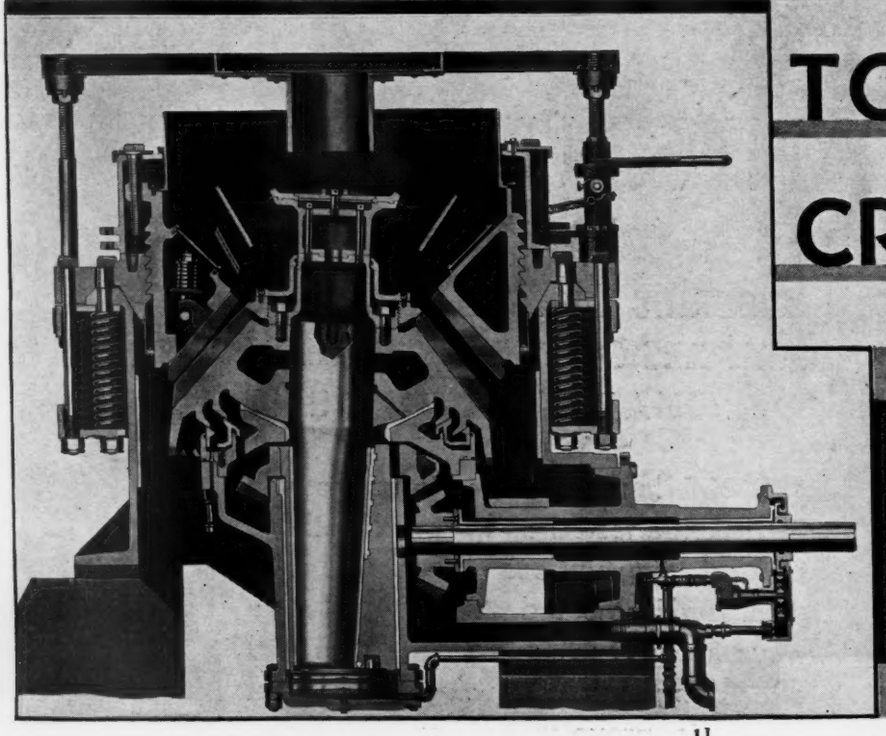

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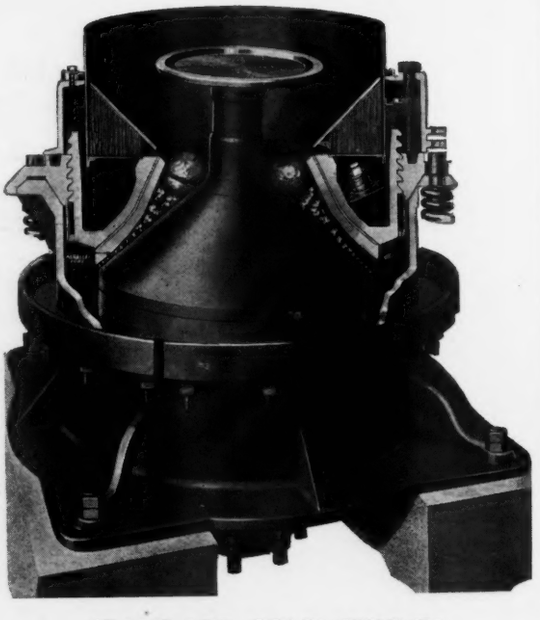
AFTER more than a year of field trials in the extremely fine crushing of a variety of materials, Nordberg now offers a companion to the Standard Cone ... the New SHORT HEAD. This newer development is of especial interest to those confronted with the problem of crushing finer than has heretofore been possible with any single piece of crushing equipment. Producing a finer and better product in greater capacity permits of a substantial reduction in fine crushing costs. The Symons Cone continues to lead the way for those who wish to crush finer.



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For reduction crushing to the ordinary sizes, the Standard Cone Crusher stands without an equal.

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I CARRIED heavy loads in my 8 long years of highway building, without reprieve. Now I've got a job . . . even harder . . . on a Hoosier farmstead.

My strength is based on the special SKF steel that went into me. Gruelling tests in SKF laboratories furnished evidence of the punishment I could stand. The final measure of my stamina is written in the records of my labors.

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Mere steel alone, doesn't make such a bearing. No mere group of men can make it either. It's a product, as all SKF Bearings are, of a world-wide organization that specializes on fine bearing manufacture . . . that works up to a predetermined standard of performance and never down to a price.

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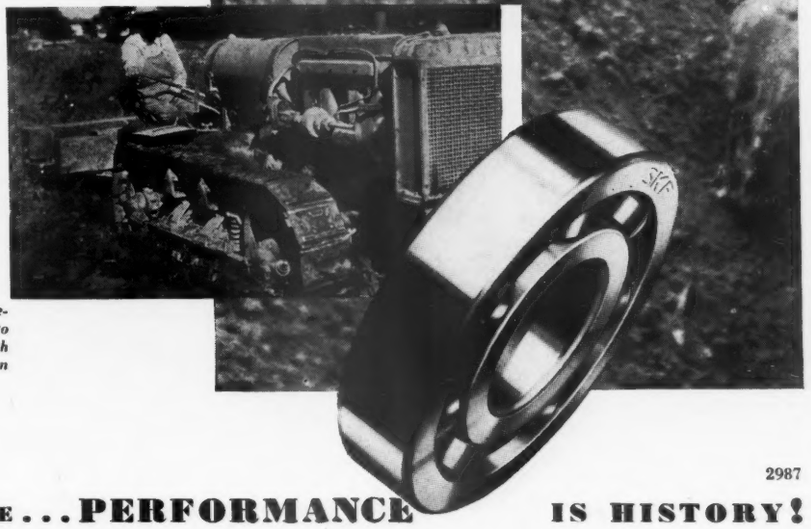

For eight years Marion County (Ind.) Highway Department road crews meted out heavy punishment to this SKF-equipped Caterpillar Tractor. Now, with the same old SKF Bearings, it is making good on an Indiana farm.

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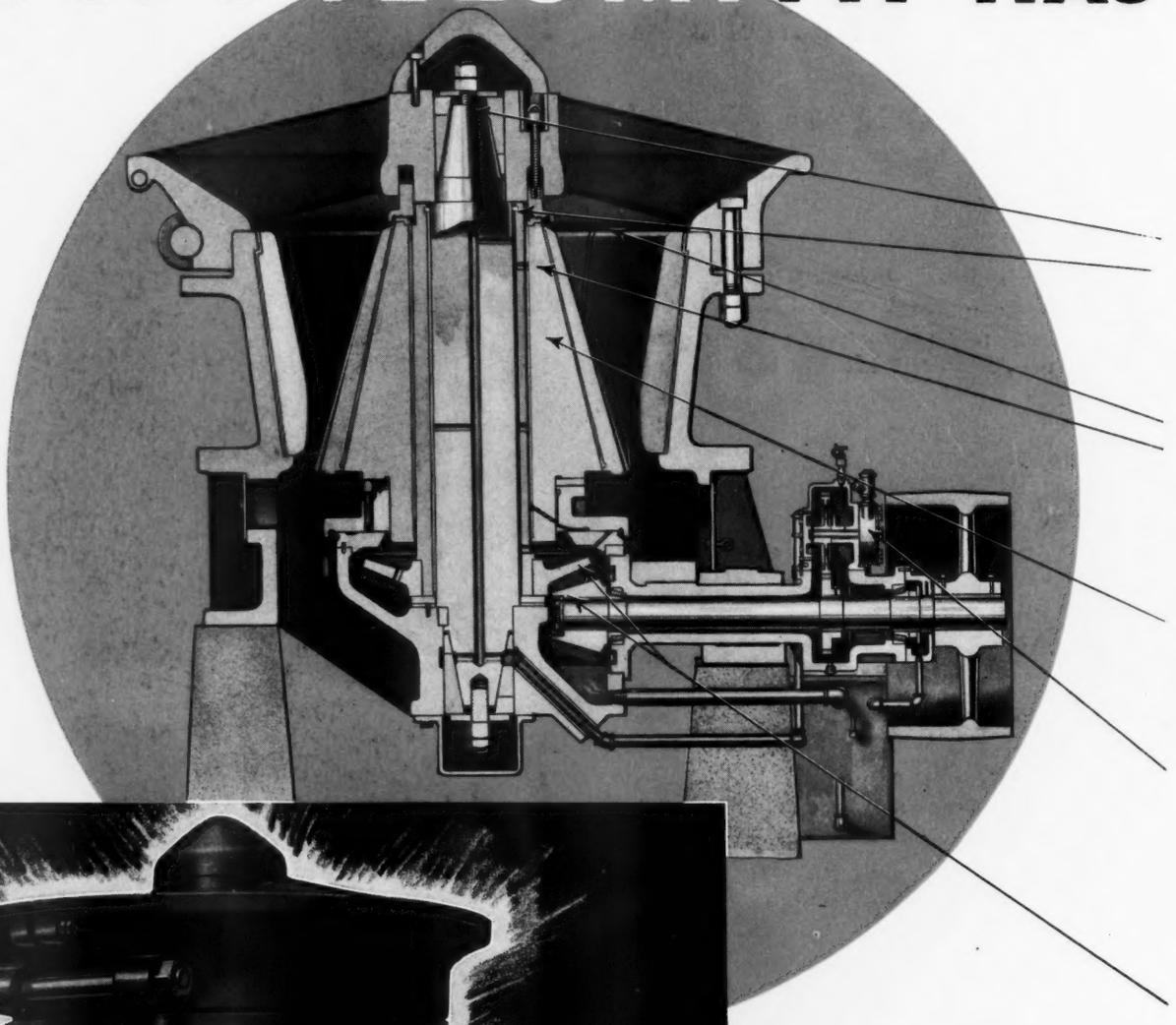

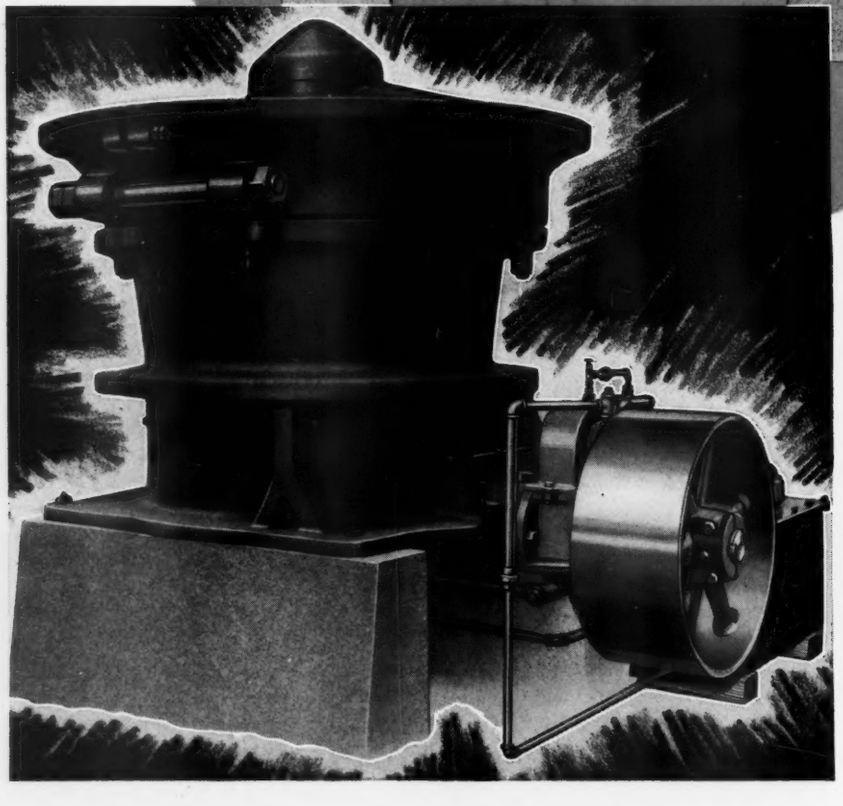

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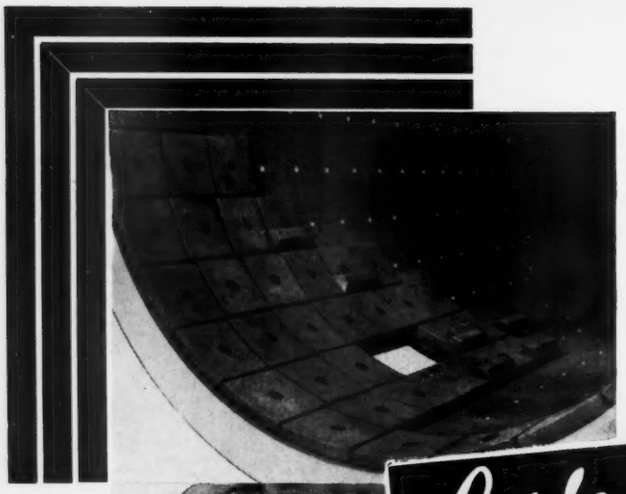

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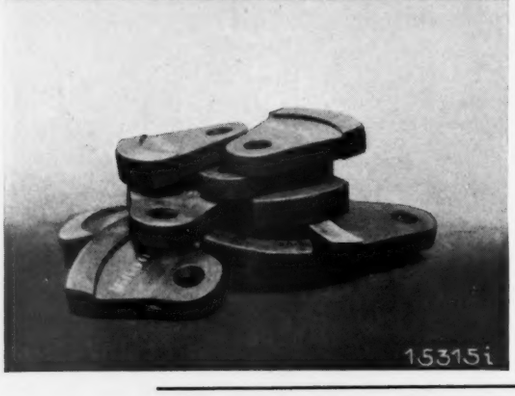

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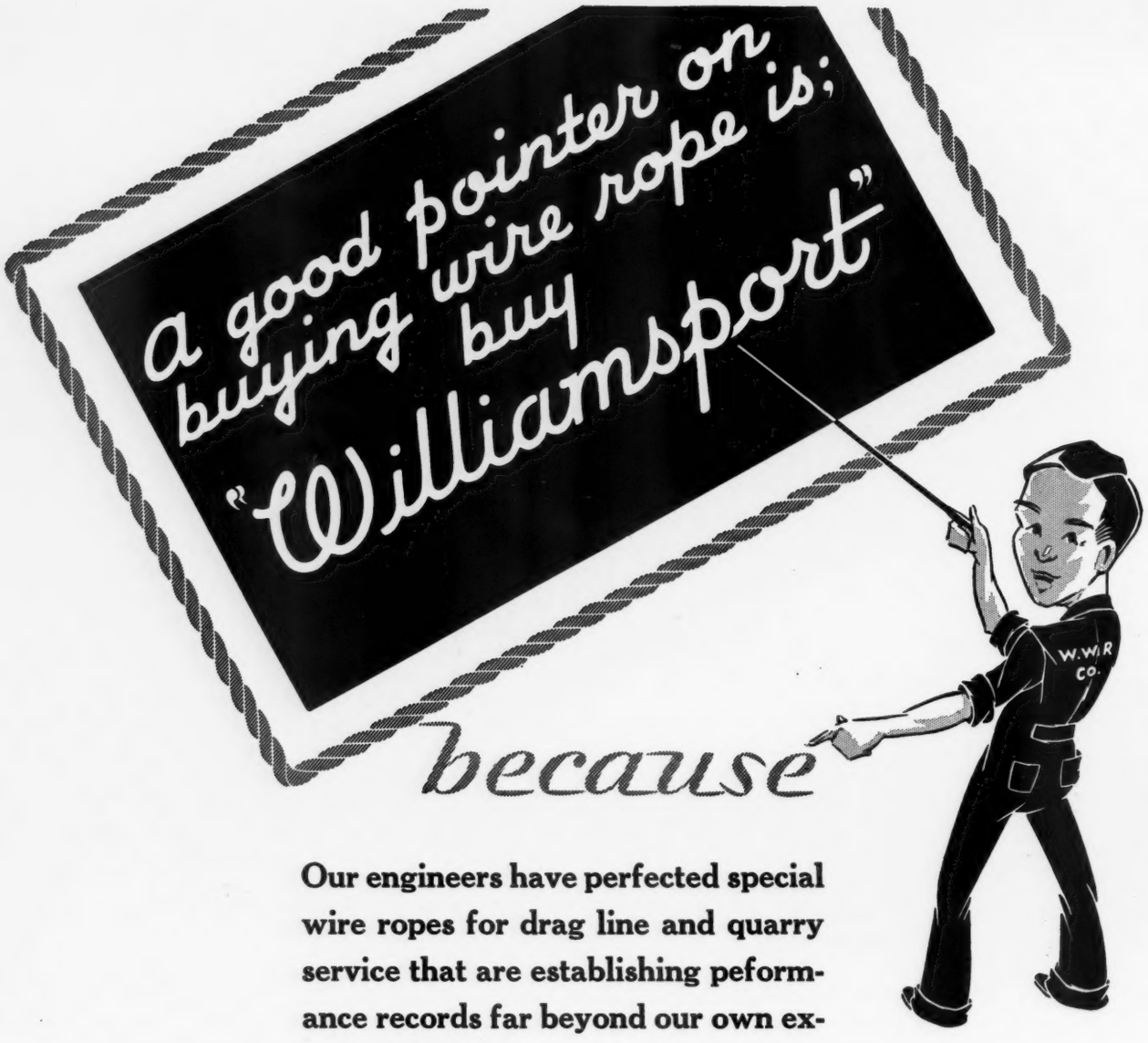

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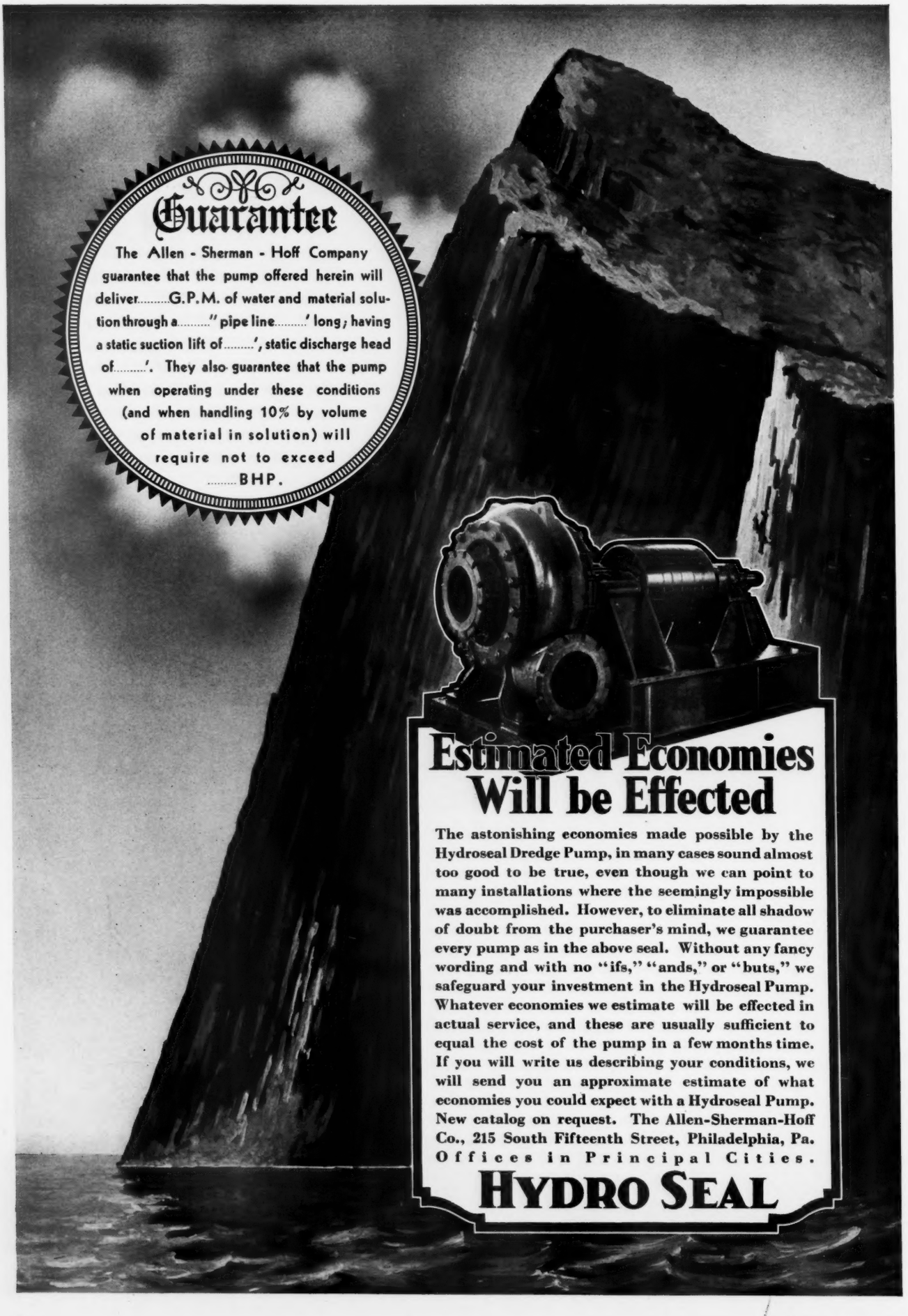
BACKDIGGERS

LIMA

3-4 YARD
1 YARD
1 1-4 YARD
1 1-2 YARD
CAPACITIES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The Allen - Sherman - Hoff Company guarantee that the pump offered herein will deliver.....G.P.M. of water and material solution through a....." pipe line.....' long; having a static suction lift of.....', static discharge head of.....'. They also guarantee that the pump when operating under these conditions (and when handling 10% by volume of material in solution) will require not to exceed .....BHP.
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The astonishing economies made possible by the Hydroseal Dredge Pump, in many cases sound almost too good to be true, even though we can point to many installations where the seemingly impossible was accomplished. However, to eliminate all shadow of doubt from the purchaser's mind, we guarantee every pump as in the above seal. Without any fancy wording and with no "ifs," "ands," or "buts," we safeguard your investment in the Hydroseal Pump. Whatever economies we estimate will be effected in actual service, and these are usually sufficient to equal the cost of the pump in a few months time. If you will write us describing your conditions, we will send you an approximate estimate of what economies you could expect with a Hydroseal Pump. New catalog on request. The Allen-Sherman-Hoff Co., 215 South Fifteenth Street, Philadelphia, Pa.
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HYDRO SEAL

VOLUME 25 NUMBER 7

Pit and Quarry

With which is consolidated

CEMENT-MILL & QUARRY

CHICAGO, MARCH, 1933

Quoted Cement Prices Good to March 1 Only

THREAT OF INFLATION IS CAUSE

The fear of currency inflation after March 4 is assumed to have had an effect on the cement companies from the fact that those which have been bidding recently on cement contracts have notified would-be buyers that all prices quoted were strictly for delivery up to March 1. The only exceptions in the case of bids tendered the city of Rochester, N. Y., for example, were orders on which the city could fix the amount of cement required for a job, in which cases delivery might be made at the prices quoted.

Representatives of the cement companies explained that the possibility of currency inflation under the Roosevelt administration was too great to warrant the making of contracts carrying over into the new president's term.

The same notice warning distributors against accepting contracts for delivery after March 1 has been given to county, state and federal public-works officials. Independent builders also have been informed that they may accept no cement at present prices after March 1, except where contracts are in the course of execution and not more than a single carload of cement is desired.

Gypsum Improvement Program Progressing

★ The United States Gypsum Co. has started the construction of a new wall-board plant near its present mine and plant at Midland, Cal. Work is progressing rapidly on the excavation for the basement and foundations of the plant and on the construction of modern homes for the workmen. A railroad spur is also being built. The new unit, which is 50 ft. by 400 ft. in size, will have a capacity of 100,000 sq. ft. of wall-board per day and is to be completed in June. The Austin Construction Co. has the contract for the structural-steel work. Sheetrock and other wall-board products will be manufactured. Hitherto most of the wall-board has been made in the middle west and shipped to the Pacific Coast.

The company also recently awarded a contract to the Lackawanna Steel Corp. for 190 tons of steel for supports for partition-tile machinery being installed in its plant at New Brighton, N. Y. These projects form parts of the $400,000 improvement program the company has under way in its various plants.

Lehigh Valley Cement Plants Resume Working

Many of the cement plants in the Lehigh Valley district which have been closed for the winter have recently resumed operation and a number of others are scheduled to resume production shortly. The Bath, Pa., plant of the Pennsylvania-Dixie Cement Corp. went into operation on Feb. 1, calling about 225 men back to work. On the same date the reöpening of the plant of the Alpha Portland Cement Co. at Martin's Creek, Pa., put 100 men back to work. The plant of the Lone Star Cement Co. at Nazareth, Pa., also recently went into operation with a crew of 160 men and the Stockertown plant of the Hercules Cement Corp. recalled about 100 men. Most of these plants were started up because of depleted stocks and in anticipation of future demand.

Closed More Than Year, Cement Plant Reopens

The Hannibal, Mo. plant of the Universal Atlas Cement Co. was put into operation on Feb. 1, after having been closed for more than a year. Over 400 men have returned and are working at least two days a week with prospects of steadier employment later. Previous to the reöpening of the plant a force of employees had been putting it in condition and laying a pipe-line for natural gas which is now being used as fuel.

The plant of the Lone Star Cement Co. at Bonner Springs, Kan., resumed operations on Feb. 1 after a shutdown of two months. About 100 men, enough to operate the plant at about one-third capacity, were called back to work.

Heart Trouble Claims W. H. L. McCourtie, Sr.

WAS TRINITY CEMENT PRESIDENT

Wendell H. L. McCourtie, Sr., former president of the Trinity Portland Cement Co., Dallas, Tex., died Feb. 6 at a sanitarium in Battle Creek, Mich., where he had been undergoing treatment for several months for chronic heart trouble. Mr. McCourtie was 61 yr. of age. He was born on a farm in Michigan and graduated from the law department of the state university in 1894. After some years spent in the practice of law he became associated with the late W. F. Cowham in the cement industry, from which association grew the present Trinity Co. which operates three plants in Texas.

Wendell H. L. McCourtie, Sr.

Mr. McCourtie had many other business connections and was reputed to be one of the major stockholders of the Peerless Motor Co. He was also internationally known as a turfman and at various times owned many famous horses. His estate in the Irish Hills section of the state was a showplace which he always kept open to the public. It was largely through his generosity that the village of Somerset Center, near which he was born, has come to be considered a model village. He is survived by the widow and a son, Wendell H. L. McCourtie, Jr.

Installs New Terrazzo Mill in Marble Quarry

★ Considerable activity has developed in the vicinity of Leslie, Ark., within the past few months. S. O. Denton has opened a black-marble quarry near that city and has installed a mill to crush this material for use in making terrazo floors. The Bond Marble & Tile Co. of Oklahoma City has also developed several deposits in this vicinity recently.

Uniform Cement Bids Stir Missouri Solons

FEDERAL GOVERNMENT WATCHES

"In pursuance to a resolution of the senate requesting me to make an investigation relative to cement companies violating the laws of the state, I will be glad to see you at my office at 10 o'clock Thursday morning, if you care to discuss the matter."

This sharp 46-word telegram, sent by Attorney General McKittrick of Missouri to nine cement companies selling in that state, not only caused a stir among its recipients but brought forth an echo from Washington, where the Department of Justice is reported to be taking an interest in the subject. The firms invited to "put their cards on the table," as Mr. McKittrick expressed it, are the Alpha, Ash Grove, Dewey, Hawkeye, Lone Star, Marquette, Missouri, Pennsylvania-Dixie, and Universal Atlas cement companies, whose plants are located in either Missouri, Kansas, Iowa or Oklahoma.

Mr. McKittrick's action followed the adoption by the Missouri senate of a resolution asking an investigation of the fact that the companies named tendered identical bids last November, when they were awarded contracts for 1,560,000 bbl. of cement for state-highway work in 1933.

In 1932 the state highway department contracted for its cement at 35 c. a bbl. net, the state paying the freight and handling charges. This year the highway department contracted for its cement at $1.25 and $1.15 a bbl. The prices quoted by manufacturers to dealers in the last half of 1931 and the first six months of 1932 were approximately $1.10 a bbl. In the last six months of 1932 the price was $1.25 to $1.35 a bbl.

Retail prices in Kansas City in 1932 were: January, $1.72; February to June, $1.44; June and July, $1.94; August to December, $1.94; December and to date in 1933, $2.04. In Sedalia, about the center of the state, the prices were: January to May, $1.69; June, $1.90; July to January 1, 1933, $2.19, and in January to date, $2.24.

A cement buyer reports that the bulk of his cement was obtained at 85 c. a bbl. last year, plus freight, or the same as paid by the state in 1932. This year, he said, his cement cost about $1.35, or a little above the contract price for the state highway department.

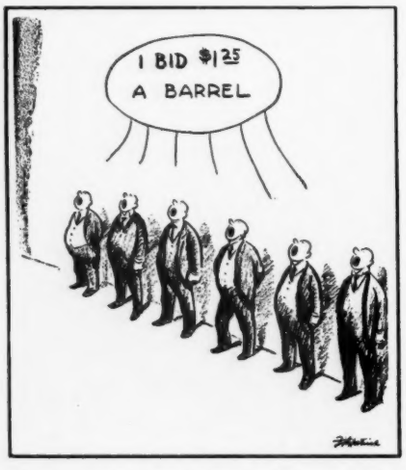
H. L. Block, president of the Missouri Portland Cement Co., said that the practice of cement manufacturers in submitting identical bids to the Missouri State Highway Department is entirely lawful, in his opinion. It is upheld, he declared, by a decision of the United States Supreme Court. His company will supply the Highway Department for 1933 with 501,000 bbl. of cement. All contracts for the west side of the state, including that of the Missouri Portland Cement Co., were at a basic price of $1.15 a bbl. and those for the east side were at a basic price of $1.25 a bbl. Cement prices, he added, are virtually standard for all manufacturers, freight and handling charges alone causing fluctuations in quotations.

Matthew S. Murray, director of public works of Kansas City, said the city was obtaining cement for street construction at $1.80 a bbl. delivered to any point in the city.

Walter H. Miller, recently-elected assessor of Jackson County, and formerly a representative of the Dewey Portland Cement Co., said the manufacturer's price to wholesalers now is $2.04 a bbl., which includes handling charges. The strip net price, such as specified in state contracts, would be $1.54.

The present situation recalls occurrences in 1924, when Jesse W. Barrett, then attorney general of Missouri, filed ouster proceedings against the Atlas Portland Cement Co., predecessor of one of the concerns furnishing cement to the state highway department this year, charging it with acting in restraint of trade. Similar charges were filed against the Ash Grove Portland Cement Co., the Dewey Portland Cement Co., and others. Both the latter firms pleaded guilty and were fined $10,000 each. The Missouri Portland Cement Co. paid a fine of $27,500 and the Continental Portland Cement Co., since absorbed by another firm, paid a $10,000 fine. Ouster decrees against these companies were stayed on condition of good behavior and the decrees subsequently were set aside following the ruling of the United States Supreme Court.

In 1925 the United States Supreme Court, passing on the activities of the Cement Manufacturers' Protective Assn., declared it was not operating in violation of the Sherman anti-trust act. The association asserted its object was to distribute to its members accurate information concerning their business, enabling them to guard against misrepresentation, deception and imposition. Government attorneys alleged it was a method to circumvent the federal anti-trust laws.



"Strange Harmony Among the Cement Boys," as the St. Louis Post-Dispatch sees it.

The Missouri suit against the Atlas company was dismissed after the United States Supreme Court decision.

The Department of Justice in Washington is interested in the Missouri situation only because interstate shipment of cement is involved. The Ash Grove and Lone Star companies are furnishing cement from their plants in Kansas, the Hawkeye and Pennsylvania-Dixie companies from their plants in Iowa, and the Dewey company from its plant in Oklahoma. The other companies have plants in Missouri. As present anti-trust laws govern interstate commerce only, intrastate commerce is not affected by them, so far as the federal government is concerned.

In June, 1921, the federal government filed civil and criminal action against certain cement producers in the East. The criminal suit resulted in an undecided jury, but the civil suit found its way, ultimately, to the United States Supreme Court.

In its civil action the government sought an injunction. It charged that the manufacturers were acting in restraint of trade, in violation of the anti-trust laws, in that they conducted a clearing-house of information which apprized all member manufactures of prices, sales and other factors relating to their business. From the exchange of this information, the government charged, the manufacturers were able to fix prices and did so uniformly, as in the case of the Missouri highway bids.

The government won its suit in the lower court, but the verdict was reversed by the Supreme Court, which held the manufacturers to be within their rights. Chief Justice Taft and Justice Sanford dissented. Since that suit was decided the government has instituted no new proceedings against cement manufacturers and contemplates none at the present time, unless investigation, yet unstarted and uncertain, in the Missouri case would disclose practices at variance with those upheld in the prior suit.

"Ever since the state highway department began buying cement, and even long before that, the prices of cement companies have been uniform," Mr. Block declared.

Frank E. Tyler, president of the Dewey Portland Cement Co., which was given a contract for 62,500 bbl. of cement by the Missouri highway department, said that the reason for the identical bids was that each company knew the basic prices of its competitors. He insisted that the companies had no trade agreement or combination of any kind. Mr. Block also denied that there was any agreement between the cement firms in submitting bids to the highway department.

(*Continued on page 20*)

Sand and Gravel Body Would Kill Surcharge

DIVERTS TRAFFIC TO TRUCKS

In its plea for the removal of the 6 c. surcharge on sand-and-gravel freight rates, filed with the Interstate Commerce Commission by the National Sand & Gravel Assn. through the latter's executive secretary, V. P. Ahearn, the following statements appear:

In the final decision in Ex Parte 103, carriers were authorized by the commission to impose an increase of 6 c. per ton on all sand-and-gravel rates. The basis of our case, and the data which we furnished in its justification, was that a blanket increase in sand-and-gravel rates would injure rather than benefit the revenues of the carriers. There has been, unfortunately for the railroads and for ourselves, ample vindication of this position. Since the imposition of the 6 c. per ton increase on sand and gravel there has been an even more decided trend toward diversion of sand-and-gravel traffic from the railroads to the truck and other competing means of transportation. This diversion is no less important to us than it is to the railroads themselves, because the diversion to truck means not only loss of business to the railroads but it also means a loss of business to the established sand-and-gravel producers whom we represent. It is no exaggeration to insist that unless present tendencies are checked, it is not altogether improbable that the railroads will lose their identity as the principal transportation medium for moving sand and gravel from the point of production to the point of consumption.

. . . The fact of the matter is that many of the railroads themselves have recognized that the imposition of the 6 c. increase could not result in increased revenue and they have themselves on occasion removed the application of the 6 c. increase.

We have a common interest with the railroads in stemming the drift toward the substitution of the wayside pit for the established sand-and-gravel plant, such as is represented by the National Sand & Gravel Assn., as a source of sand-and-gravel supply. The established plant depends in an overwhelming percentage upon the railroad; the wayside pit does not contribute one pound of sand and gravel to the revenues of the carriers. Therefore, our members are as anxious as the railroads that they should derive more revenue from sand-and-gravel transportation, for high freight charges encourage the development of local sand-and-gravel operations, and we and the railroads as well suffer a financial loss.

Any increase in freight rates which has as its objective the production of greater revenue for the carriers, embodies the assumption that higher rates would not disturb the existing flow of traffic. In the case of sand and gravel such an assumption is fallacious. In every instance the delivered price of sand and gravel represents a greater percentage of freight charges than it does plant cost, for our materials, of heavy loading and low-value characteristics, have a limited shipping radius. Sand and gravel are highly sensitive, therefore, to even the slightest increase in rates. Any disturbance in the delicate balance which governs sand-and-gravel transportation is certain to have the twofold effect of distorting competitive relationships and of diverting the movement from railroads to trucking and other methods of transportation.

It has been a policy of the carriers to make rates relatively higher for short distances because terminal expenses are constant and the longer hauls tend to absorb them, but the inflexibility in rate-making to which they have permitted this theory to lead them has resulted in a rapidly-declining volume of sand and gravel business. The National Sand & Gravel Assn., not only in Ex Parte 103 but in previous proceedings before your commission, has been consistent in urging the carriers not to increase their rates on such a short-haul business as sand and gravel to the point where the movement of these materials will be defeated by economic forces. While the production of sand and gravel was increased more than 25,000,000 tons annually during the period from 1927 to 1929, railroad movements were decreasing. The carriers, therefore, not only secured none of the increased production, but actually lost ground on the basis that the production had remained constant. We of the established sand-and-gravel industry, with permanent plants at fixed locations and depending almost exclusively on the railroads, have shared in this loss with the railroads.

The following figures show the definite trend away from railway and toward truck transportation in recent years:

Sand and Gravel (*short tons*)	1928	1929	1930	1931
Total production (Bureau of Mines)	171,944,522	180,810,590	169,181,050	137,799,170
Revenue shipments (Class I railroads)	85,667,157	81,408,069	73,983,841	53,562,437
Shipped by railroads (*per cent*)	49.8	45.0	43.7	38.9

It will be seen that the percentage of total production handled by the railroads was already declining when the railroads asked for the 6 c. surcharge, and that in the year of its imposition railroad shipments showed a higher rate of diminution than in previous years.

Nine Cement Companies Share Missouri Awards

The Missouri state highway department has awarded contracts for Portland cement to be used during 1933 as follows: Missouri Portland Cement Co., 501,100 bbl.; Universal Atlas Cement Co., 318,800 bbl.; Marquette Cement Manufacturing Co., 278,200 bbl.; Alpha Portland Cement Co., 233,200 bbl.; Dewey Portland Cement Co., 62,000 bbl.; Ash Grove Cement Co., 62,000 bbl.; Lone Star Cement Co., 62,000 bbl.; Hawkeye Cement Co., 21,000 bbl., and Pennsylvania Dixie Cement Corp., 21,000 bbl.

Lime Firm's Workmen Are Building New Plant

★ Work is progressing rapidly on the new rotary-kiln lime plant being built by the Kelley Island Lime & Transport Co. at Clay Center, O., and it is expected to go into operation shortly. All this work is being done by company employees. This is in line with the company's policy of keeping all employees busy full time even when not operating its plant. Early last autumn the use of steam shovels for loading stone in the quarry was discontinued and all picking and loading has since been done by hand.

Builds Facilities for Shipping by Railroad

★ The Bluffton Stone Co., Bluffton, O., is installing a railway siding at its plant in order to expand its present market. This siding, which will be 1,000 ft. in length and is being built on a fill 8 ft. high and wide enough for a side-track, entails an expenditure of about $4,300. According to Raymond Conrad, secretary of the company, it will be ready for use about April 1. When this plant was built in 1930 provisions were made for truck shipments only.

California Firms Get Big Aggregate Orders

According to recent information, materials for the construction of the projected bridge across the Golden Gate in San Francisco will be transported to the job by barges. Bulk cement will be loaded into barges at the plant of the Pacific Portland Cement Co. at Redwood City, Cal., and hauled to the two ends of the bridge site, where it will be handled through pneumatic tubes to steel storage-silos of 5,000 bbl. capacity each. The contract for mixing the concrete for the bridge foundations and anchorages has been secured by the Pacific Coast Aggregates Co., which will erect large batching plants at Fort Point and Lime Point. Truck-mixers will haul the concrete from these plants to the points where it is to be poured. According to Charles M. Cadman, president of the aggregate company, the rock, sand and gravel to be used will come from Sonoma, Napa, Alameda, and Contra Costa Counties.

Chicago's Mayor Rejects One-Price Cement Offers

Mayor Cermak has directed the Department of Public Works of Chicago to reject the bids received for furnishing the city cement on the ground that all the bids received—there were three of them—were "identical to a cent and 40 per cent. higher than last year's." The bidding companies, according to a statement issued by the mayor, were the Moulding Brownell Corp., the Consumers Co. and the Materials Service Co.

"Each bid was accompanied by a letter," Mayor Cermak stated, "in which the bidder refuses to guarantee that his prices will remain in force for any length of time. In effect they have all submitted rubber bids. The city has not accepted bids of this character in the last thirty years."

The mayor's statement adds that six large cement companies in Greater Chicago are operating at less than 15 per cent. of capacity, and he considers it surprising that none of these submitted bids.

Buffalo Slag's Gravel Plant Gets New Screen

★ The Buffalo Slag Co. recently installed a Simplicity Engineering Co. D'centegrator in its gravel plant at Attica, N. Y. This installation was made to remove about 14 per cent. of clay shale present in some parts of the deposit.

West Coast Producer Uses Portable Plants

LATEST UNDERTAKING CITED

Southern California aggregates producers are fast becoming aware of the advantages of the portables and so-called semi-portable plants, especially for supplying material on paving jobs in mountainous sections where long hauls over steep grades are encountered. The Imperial Rock Corp., of Los Angeles, has specialized in production from portable plants in recent months and it has just obtained the largest contract for this business since it began supplementing its permanent operations about Los Angeles with portable plants. The contract involves more than 100,000 cu. yd. of washed-and-screened aggregates to be used in laying 27 mi. of concrete pavement 30 ft. wide on what is known as Ridge Route Alternate, between Castaic and Gorman, Cal. The paving contractors' schedule calls for the completion of a mile of highway per week. Work was started Feb. 15 and is expected to be completed about Aug. 15. Under the schedule 900 cu. yd. of concrete must be produced and placed each 8-hr. day. Under the terms of the contract no work is to be done Saturdays, Sundays, or holidays.

Supplying aggregates for this job is a big undertaking as well as a hazardous one, when one considers the volume of material which must be supplied daily. State highway engineers designated three gravel deposits along the route where the material will be produced. The portable plant has been set up on its first location at Castaic, Cal., and will be moved to the other two deposits as work progresses.

The plant is of all-steel construction of the so-called semi-portable type and was designed and built especially for the job by the Standard Steel Works of Los Angeles. Crushing is accomplished by a 3-ft. Telsmith cone crusher, a 3-ft. Telsmith gyratory and a 15-in. by 16-in. Wheeling primary crusher. Revolving and vibrating screens as well as a feeder and the conveyor carriers were supplied by the Stephens-Adamson Mfg. Co. The Hurt Conveyor Co. and the Brown-Bevis Co., Los Angeles, furnished the 480 ft. of 26-in. and 30-in. conveyor belting employed. A 50B Bucyrus-Erie Diesel-engine shovel excavates the raw material at the pit and fifteen 5-ton Moreland dump trucks carry it to the plant. These trucks also deliver batches of cement and washed-and-screened material to the mixers.

A Blaw-Knox bulk-cement plant is located adjacent to the portable aggregates plant and cement in bulk is brought direct by tank trucks from the plant of the Monolith Portland Cement Co. at Monolith, Cal. Six Johnson automatic weighing matchers are used to proportion the dry mix.

Glen Wright, pioneer aggregates producer in southern California is supervising operations for the Imperial Rock Corp. Mr. Wright is the founder of the Orange County Rock Co. and his operating superintendent, James Worthington, will be in charge of the erection and moving of the plant as well as production.

Indianapolis Operators Get $100,000 Contracts

Contracts for sand and gravel to be used in highway construction and maintenance during 1933 in the Indianapolis district were recently awarded by the Indiana Highway Commission.

More than $100,000 worth of material was involved in the awards which were distributed among the following producers in the Indianapolis area: American Aggregate Co., Brown-Hunstater Material Co., Fall Creek Gravel Co., Speedway Gravel Co., Indiana Gravel Co., Keystone Gravel Co., Indianapolis Sand & Gravel Co., and the Glens Valley Gravel Co.

Santa Cruz Firm Gets 350,000-Barrel Order

The Santa Cruz Portland Cement Co. recently received from the federal government an order for 350,000 bbl. of cement for the construction of the Madden Dam in the Canal Zone. As a result, the plant is now operating three extra kilns for the first time in a year and 160 employees have been put on a full-time basis after months of part-time employment. According to Geo. R. Gay, manager of the company, this order is fully one-half of the entire shipment of the plant in 1932. The contract calls for delivery of the cement between March 1 and Dec. 1 of this year.

Slate Producer Buys Modern Air-Separator

★ The Funkhouser Co., producer of slate granules, has installed a 14-ft. Raymond mechanical air-separator in its plant at Delta, Pa. This is being used to remove the fines created in the manufacture of the granules and separate them into several different grades for commercial uses.

Uniform Bids (*From page 18*)

Mr. Block agreed with Tyler that the prices paid by the highway department for cement last year were far below what they should have been.

"The result was that all the companies suffered losses," he said. "We lost $300,000. The price this year is high enough but it is 23 c. a bbl. below the average for the last five years."

Arizona's Asbestos Industry to Revive

NEW HIGHWAY WILL CUT COSTS

Arizona asbestos producers are looking forward to a profitable season in 1933—all because of the construction of a high-type highway from Globe, Ariz., northward to the town of Springerville, a distance of 95 mi. The route of the new highway passes through the drainage basin of Salt River near Chrysotile, where five producers operate asbestos mines and plants. In the past shipments have been made by motor truck to the nearest railway station at Rice, Ariz., a distance of about 50 mi. This old road, extremely rough over its entire distance, has made transportation slow and expensive. But when the new road is completed, the trucking distance will be reduced by 35 mi., cutting the cost of delivering the finished fibre fully 80 per cent., according to estimates by producers.

Most of the mines and plants have been either closed or operating but a few days in each month, the high transportation costs having made competition with Canadian asbestos impossible. The new road will put the producers on a much firmer footing and the brighter aspect for the industry in Arizona is being reflected in a stir of activity about the properties. Equipment is being overhauled and made ready for increased production and the additional employment of several hundred men is expected. And, along with the lowered cost of trucking the material, operators will be able to ship the lower-grade fibers. In the past these have been ignored, only the highest quality of asbestos having been processed.

Operators in the Salt River basin include the Johns-Manville Co., Triangle Asbestos Mines, Inc., Arizona Asbestos Assn., Emsco Asbestos Co., and Regal Asbestos Mines, Inc. The asbestos occurs as a fibrous form of serpentine, in veins lying within limestone formations. Perhaps the largest of the operations is that of Emsco Asbestos Co. The crude ore, which averages from 15 to 20 per cent. fiber, is transported from the deposits to the treatment plant near Chrysotile by an aërial tramway more than 1,000 ft. long. After crushing, the refined asbestos is extracted by centrifugal separators. The Emsco plant has a capacity of about 8,000 lb. of high-grade fiber per day, but with the utilization of the lower grades which the new road will make possible, this capacity will be more than doubled. Electricity for power is obtained at the plant by gasoline engines which drive the generators.

The building of the Kimbleton Lime Co., Shawsville, Va., has been damaged by fire.

Decision on Gas Tax Is Pending in Illinois

SOME PROPOSALS FOR DIVERSION

According to recent press dispatches the governor's highway advisory commission will recommend to the Illinois general assembly that the present system of distribution of the $46,000,000 annual taxes collected from the motorists of the state be continued. This commission, created in 1931, proposes that the state continue allocating half of its 2 c. from the 3 c. gasoline tax for improvements within the municipalities, the apportionment being made among cities in accordance with population. The counties would continue to receive 1 c. of the gas tax to be used for charity relief or for roads.

Numerous other proposals are being advocated, among them one which would take $25,000,000 of the state collected tax and distribute it among counties, townships and cities to be substituted for an equal amount of direct property taxes levied by these smaller political units for roads and streets. Still another proposal would allocate 1 c. to the state highway department, 1 c. to the counties and 1 c. to the Illinois Emergency Relief commission.

Stepanian Heads Ohio Sand Producers' Body

The Ohio Sand & Gravel Producers' Assn. held its annual meeting at the Neil House, Columbus, O., on Feb. 3. Stephen Stepanian of the Arrow Sand & Gravel Co., Columbus, was elected president of the association, succeeding J. J. Gorman of the Zanesville Gravel Co. The other officers are: A. E. Frosch, Eastern Ohio Sand & Gravel Co., East Liverpool, vice-president; J. H. Evans, Sturn & Dillard, Circleville, secretary and treasurer. In addition to Mr. Gorman the members of the executive committee are: C. E. Glander, American Aggregates Corp., Greenville; H. J. Knight, Rubber City Sand & Gravel Co., Akron; and E. W. Trettschuh, Ohio Gravel Co., Cincinnati.

Hunter, N. Y., Buys Crushing Equipment

★ The town of Hunter, Greene County, N. Y., has purchased from the Universal Road Machinery Co. a 150-ton storage-bin, an elevator and a screen to be used with a 14-in. by 24-in. Reliance jaw crusher previously purchased from this company.

Air-Separator Takes Out Clay Impurities

★ The Superior Kaolin Co. has installed a system at its Dry Branch, Ga., plant which is a departure from the methods commonly used in kaolin plants. The method is to dry the clay and then disintegrate it before passing it to a Raymond mechanical air-separator which removes any impurities. The tailings go to a Raymond throw-out pulverizer which reclaims the good clay.

Concrete Gravel Buys Gravel-Washing Screw

★ The Concrete Gravel Co., Hattiesburg, Miss., has installed an Eagle single-screw gravel washer, with a capacity of 75 tons per hr., in its plant at Lux, Miss. This installation was made to remove silt and mud balls from the gravel.

Federal-Aid Bill Is Attached to Gas Tax

The House of Representatives recently passed a bill (H. R. 14416) to make the federal tax on gasoline effective until June 30, 1934, thus extending its operation for one additional year. The bill then went to the Senate and when it was called up on Feb. 10, Senator Smoot requested that it lay over in order to allow Senator Oddie of Nevada to attach to the bill as an amendment the regular federal-aid highway bill, authorizing continued federal assistance in the construction of highways for the fiscal years 1934 and 1935 (calendar years 1933 and 1934.) This amendment to the gasoline tax bill contains the full provisions of Senate Bill 36 which passed the Senate on June 8, 1932.

If H. R. 14416 as amended passes the Senate, it will then be returned to the House. The usual course would be for the House managers of the bill to move for a disagreement to the Senate amendment and request a conference with the Senate. Both branches of Congress would appoint members of a conference committee, and in that committee would lie the fate of the legislation. It is possible that the House managers would be sympathetic to a continuation of highway appropriations, and that there would be an excellent chance of getting at least an authorization of $100,000,000 per year. Furthermore, there is an advantage in connecting gasoline-tax legislation and highway appropriations. Federal gasoline taxes are estimated to raise about $135,000,000 in the next fiscal year, and if no money is appropriated for highways, there will be a diversion of highway funds on an unprecedentedly-large scale.

New Mississippi Gravel Plant Now in Operation

★ The Mississippi Sand & Gravel Co., Inc., which late in 1931 purchased the interests of the Kolola Gravel Co., has completed its new 20-car plant near Rosedale, Miss.

FEDERAL-AID FUNDS AVAILABLE FOR CONTRACTS, FEBRUARY 1, 1933

State	Remainder Federal-Aid Funds For New Contracts	Remainder Emergency Highway Funds Available For New Contracts	Total Federal Funds Available
Alabama	$ 3,315,399	$ 113,810	$ 3,429,209
Arizona	128,134	231,357	359,491
Arkansas	1,448,409	1,018,324	2,466,733
California	52,051	220,199	272,250
Colorado	805,465	1,095,043	1,900,508
Connecticut	17,881	3,116	20,997
Delaware	33,026	16,182	49,208
Florida	1,241,804	225,268	1,467,072
Georgia	84,697	47,699	132,396
Idaho	75,428	149,062	224,490
Illinois	126,899	.....	126,899
Indiana	123,082	946,213	1,069,295
Iowa	11,498	92,983	104,481
Kansas	349,958	430,949	780,907
Kentucky	153,099	209,917	363,016
Louisiana	8,644	1,359	10,003
Maine	72,744	1,474	74,218
Maryland	32,060	305,663	337,723
Massachusetts	30,738	.....	30,738
Michigan	120,096	290,534	410,630
Minnesota	47,190	336,559	383,749
Mississippi	3,605,579	714,103	4,319,682
Missouri	307,560	1,221,615	1,529,175
Montana	195,372	.....	195,372
Nebraska	298,699	250,671	549,370
Nevada	60,955	482,963	543,918
N. Hampshire	112,616	182,366	294,982
New Jersey	65,234	.....	65,234
New Mexico	267,392	715,744	983,136
New York	.....	15,000	15,000
N. Carolina	1,584,117	618,744	2,202,861
N. Dakota	222,493	64,502	286,995
Ohio	233,614	246,793	480,407
Oklahoma	434,169	602,397	1,036,566
Oregon	109,263	145,192	254,455
Pennsylvania	26,340	.....	26,340
Rhode Island	24,932	.....	24,932
S. Carolina	.....	.....	.....
S. Dakota	55,377	12,066	67,443
Tennessee	549,330	.....	549,330
Texas	.....	490,914	490,914
Utah	211,910	499,093	711,003
Vermont	16,038	146,814	162,852
Virginia	310,232	217,222	527,454
Washington	94,532	50,969	145,501
W. Virginia	194,007	.....	194,007
Wisconsin	63,392	7,500	70,892
Wyoming	4,053	199,243	203,296
Hawaii	749,437	38,243	787,680
Totals	$18,074,945	$12,657,865	$30,732,810

Stone Plants Get New Crushing Equipment

★ The Lane Construction Corp., Meriden, Conn., installed an Acme fine-reduction crusher in its plant at Berkshire, Mass. A 24-in. by 40-in. Acme primary crusher has also been installed by this company at its plant near Westport, N. Y.

New Crusher Installed To Make Fine Material

★ Gotlieb Keil, Hudson, N. Y., recently installed a new 10-in. by 30-in. Universal Road Machinery Co. Reliance jaw crusher with a tailings conveyor in his crushed-stone plant. This is used for recrushing rejections from a 14-in. by 24-in. Reliance crusher previously installed. This improvement was made in anticipation of a demand for fine material.

★ The J. M. Huber Pigment Co., Langley, S. C., recently purchased a 1¼-cu. yd. Marion electric shovel.

Editorial

Government and Business

IT was Herbert Spencer who said, in comparing the effects of theology and government, that the former is based on the fear of the dead and the latter on the fear of the living. To the second half of his comparison he might with equal truth have added that government is based also on the ideas of the dead, because legislators do not long survive the passage of the laws they sponsor and because it is more difficult to repeal than to enact them. This condition arises partly from an undue reverence for existing laws as the contributions of those who, because dead and therefore removed to a considerable distance from the present scene, are credited with an uncommon and almost superhuman sagacity, and partly from a natural inertia that tolerates things as they are—even though admittedly wrong—rather than make the mental and physical effort necessary to change them. In the confusion of daily life the incongruities and absurdities of the situation are evident to but a few, while their harmful effects are felt by all.

The outmoded laws which hamper the normal development of business are fair examples of the imprint which one generation leaves on its successors. In an age when many tasks which formerly required the exercise of human intelligence are performed by mechanical means, when sounds and symbols cross oceans and continents without the use of man-made media, when great machines are started and stopped by the winking of "electric eyes," when technology moves forward every minute to new achievements, the laws which surround and restrict the development of these and similar accomplishments embody the ideas of half a century ago. While the natural objectives of business lead men ever forward into new and unexplored fields, their activities are needlessly and foolishly hampered by the punitive standards of men who are dead. While commerce is bent on the future, the law leans on the past. We are forced to face and solve coming problems which have never arisen before with the viewpoints and the methods devised for conditions which will never recur. And what are reputed to be the "best minds" of every age devote their lifetimes to perpetuating a system whose only title to regard is its antiquity and whose only power of commanding respect is its tradition of acceptance.

Every day business experiences the hardships imposed by the once adequate but now antiquated ideas of dead legislators. Let two business men agree to be sensible in the light of 1933 conditions and they become lawbreakers according to the standards of 1890. Let them arrive independently at the very wise conclusion that they are in business to make money and that therefore prices must be higher than costs, and they are suspected of collusion in a desire to rob the public by charging more than their product is worth. Let them by any chance adopt the same prices for what is to all outward appearances almost identical products—made and sold under similar conditions and at similar costs—and they are fit subjects for senatorial inquiry by state and/or federal government.

The cement industry has lately seen fresh evidence of the untiring zeal of those who live out of the enforcement of worn-out laws. When nine cement companies offered the Missouri State Highway Department their products last autumn and agreed to the penny in the price they asked for them, anyone with half a brain could have predicted the train of circumstances that ensued. Given a newly-elected nest of officials, intent upon demonstrating their keen love of the people and their burning desire to protect their interests; given, too, the approval of an overwhelming success at the autumn elections and the need for justifying the confidence then reposed in them by a public sick of unemployment and sick of business; and given, furthermore, the opportunity of picking on some conspicuous examples of cruel and relentless "big business," that reliable old scape-goat that can always be depended upon to make a good public show—given these conditions, the outcome was inevitable.

So, as reported elsewhere in these pages, the attorney general of Missouri has launched an investigation, the federal government is reported to be waiting in the best Wilsonian manner, and the newspapers have discovered in the situation good material for the cartoonists. And all this hubbub is created because nine cement manufacturers, anxious to restore cement prices to a level somewhere near or above the profit line, quote exactly the same price on products that are made within a relatively small territory, from similar raw materials, by similar methods, in similar plants, and for one purpose.

AMONG a people that prides itself, however unjustly, on its intelligence, such a spectacle ought to be impossible. We smile contemptuously at the gullibility of the Romans whose mistrust of their governors was appeased by giving concessions to the rich and circuses to the poor, yet we display the same silly belief in the sincerity of our politicians, who, while they entertain us with donkeys in their council chambers and occasional thrusts at "big business," divert our attention from more important but less apparent matters.

The cartoonist of the *St. Louis Post-Dispatch* characterizes this uniformity of bidding on the part of the cement manufacturers as "Strange harmony

among the cement boys," implying by the use of the word "strange" that the uniformity arises from a desire to mulct the public. While we see in the cement makers' action a certain strangeness—since it was certainly unexpected in view of the general price-cutting which has prevailed in the industry in recent years—it does not, in our opinion, indicate intent to defraud. In a capitalistic system, from which the politicians extract their livelihood and in which the motive is profit, we see no reason to complain of an action whose sole object seems to be the making of a reasonable profit in an industry that has been profitless and the consequences of which have no ill effects on the public interest.

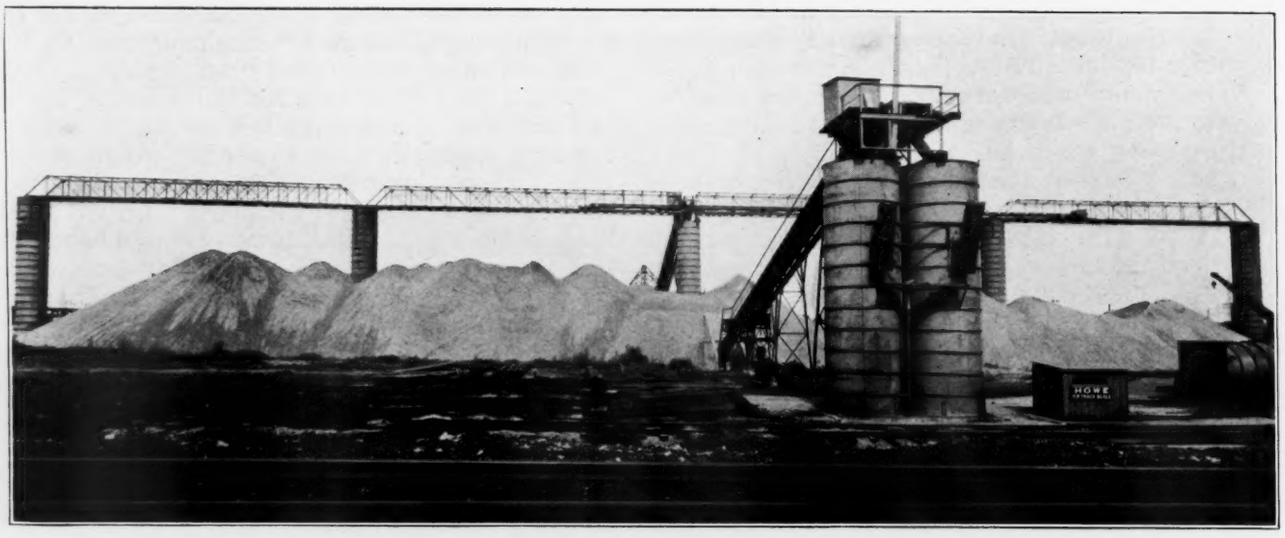
SUPPOSE the cement manufacturers did in fact, as alleged, agree to ask a uniform price for their products and thus seek to establish their production on a profitable basis. The state will undoubtedly on that account pay more for its cement, but is its policy one of strangling business in order to buy cheaply? Since when are politicians interested in economy? And, since the state requires the cement on which bids were asked and will undoubtedly buy it at any reasonable cost, how does the uniformity of the bids result in a restraint of trade? And even if such a restraint did result, what loss is borne by anyone in transacting a small business at a profit as compared with a large business done at a loss? If the state is anxious to force business to sell its products at a loss, how does it expect business to continue to employ men and keep them off the poor-relief lists? And, if the politicians want to increase the poor-relief lists and widen the operation of public charity, where do they expect to obtain the necessary relief funds, if business and employment decline further?

Of course, the ready answer will be that such collusion—if collusion it be—is forbidden by our anti-trust laws and, therefore, must be punished. To which we reply that any legislation that results more often in preventing the harmless transaction of business on a profitable basis than in preventing injury to the public (which was the end sought by its sponsors) is unworthy of recognition by a sensible people and deserves either to be repealed or to be modified to a degree that will preserve its salutary effects while eliminating its inevitable injustices and absurdities. Although action looking toward such a goal has been taken, attainment of the objective is obstructed by all the weight of inertia, blind faith in the infallible wisdom of those who proposed and enacted our existing anti-trust laws, and a senseless belief that things are best as they are. The latest development in Missouri, duplicated to a great extent by the action of Chicago's mayor in ordering identical cement bids thrown out, indicates the high cost of delay in correcting evils which all sensible men see and acknowledge but which they are nevertheless slow to remove.

From still another quarter the cement industry is being attacked by political forces. Not satisfied with the prices quoted for commercially-made cement, some politicians are again advocating the construction of state-owned cement plants. This agitation has already been revived in several states and although it more often than not represents merely a threat designed to depress prices, in one case, that of Colorado, it has reached the point where a bill for the construction of a cement plant has been proposed. There is every reason to believe that similar proposals will appear elsewhere, especially if the threats implied in some of the existing plans have the desired effect.

While we do not believe that politicians generally are much interested in speeding the arrival of state socialism—since such a system will not provide them with either the ease or the gratuities to which they have become accustomed—it is apparent to everyone that politicians are by nature, by habit, or by preference job seekers and job holders. They seize everything and relinquish nothing, and inasmuch as such a policy is not conducive to long-range looking it is not to be expected that they will see the futility of striving for huge private gains while at the same time suffocating business activities which are the only source of such gains. They may be counted upon to press for ever-widening opportunities for government activity with its chance for trading in concessions and abuses and for attaining rewards out of all proportion to the services rendered. We must not be astonished, therefore, if we see politicians, even the most outspoken and sincere opponents of all forms of socialism and communism, encroaching ever and ever more widely upon and delving ever and ever more deeply into the realm of business, where the profits have been (and may again be) large, where the opportunities for commercial exploitation have been (and can again be) greatly increased by conspiracy with politicians, and where the rewards have been (and doubtless will again be) enormous.

TOO many business men have made politicians their allies in their desire to obtain concessions useful to themselves and detrimental to the public interest. As a result, politicians look upon business as their natural hunting ground and even those business men who have not had any improper dealings with them are suspected by politicians of being willing to enter any alliance that can be made profitable to both. In the hands of this thoroughly up-to-date type of politician government is in grave danger of degrading to the level of racketeering, a form of activity in which it may become the victim as well as the exponent of exploitation. For this reason business must watch more closely and oppose with more strength than ever before these increasingly numerous manifestations of a growing tendency on the part of government to hamper the publicly-useful development of business. It must fight not only against the ideas of the dead but, the oppression, and in the more modern development of government activity sometimes the dishonesty, of the living.



The sand-handling plant of the St. Louis Material & Supply Co. with loading conveyor from stock-piles and silos in foreground. Railroad track scale at right.

St. Louis Sand-Handling Plant Can Store or Ship Materials as Required

Ample Storage Capacity Allows Shipments to be Made During Entire Winter Season

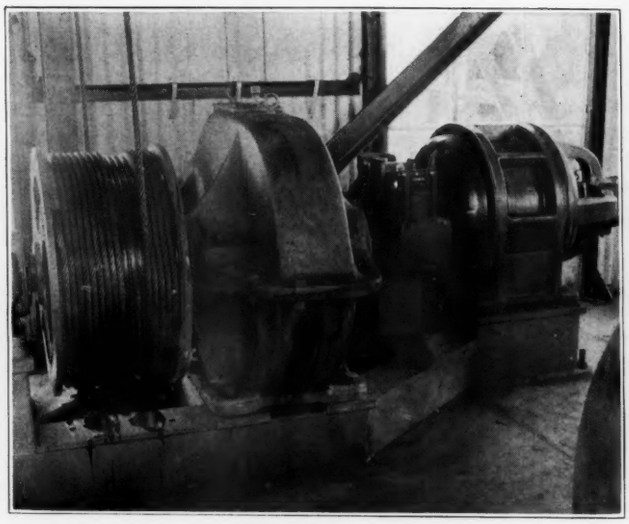
By W. E. TRAUFFER

THE metropolitan district of St. Louis, Mo., is in a peculiar situation with regard to its sources of supply of aggregates. Both gravel and crushed stone are extensively used and for years the competition between producers of these two materials has been keen without either class having been able to secure any great advantage over the other. Crushed stone is secured from a few large crushed-stone plants on the Illinois side of Mississippi River and from a number of smaller plants on the Missouri side, some actually being inside the city limits. The bulk of the crushed stone used in the city comes from within a 10-mi. radius from the business section. Gravel, on the other hand, comes largely from several localities at distances of from 30 to 42 mi. from the city. The lower production costs of the gravel plants are, therefore, offset by the necessity of paying higher freight rates. As a result neither industry has any marked price advantage. Sand is plentiful in the bed of Mississippi River near St. Louis and this is the main source of this material. Because of the proximity of this source of sand the gravel plants cannot easily compete with producers of Mississippi River sand on sales within the city of St. Louis and for this reason waste much of their sand. This creates an unusual condition, as the result of which the gravel, crushed stone, and the sand used with both these materials come from three different sources.

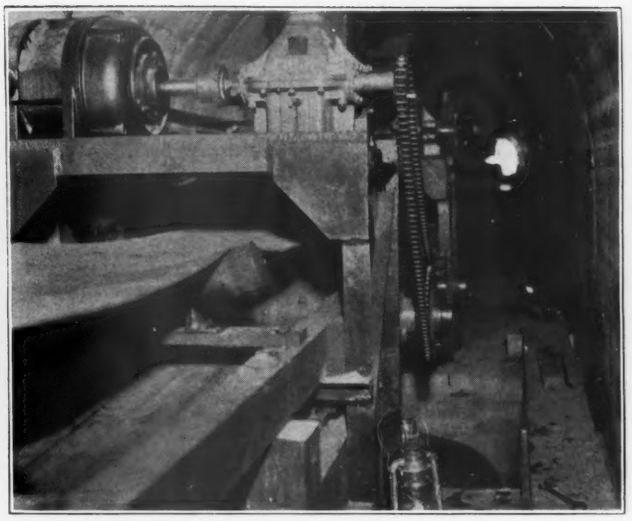
The unloading tower handling sand from a barge to the plant belt-conveyor.

Most of this river sand is dredged hydraulically and is sized on the dredges. It is then shipped by barges to numerous shore plants on the St. Louis waterfront, where it is stored and whence it is distributed.

The newest, and probably the most economical, of these shore plants is the one op-



One of the electric-motor-driven hoists operating the unloading tower.



Speed reducer and chain drive of one of the tunnel reclaiming conveyors.

erated by the St. Louis Material & Supply Co. at the foot of Branch St. in St. Louis. This plant, which is less than two mi. from the downtown section of the city, went into operation on May 1, 1932. Its loading and unloading capacity is 300 tons per hr. and it has a total storage capacity of over 100,000 tons, of which about 45,000 tons is live storage of material reclaimable through the tunnels, while the remainder can be rehandled by crane if necessary. Concrete, plaster and mortar sands are handled.

The plant was designed by the late F. J. Reinke, chief engineer of the company, after consultation with Mr. Fasmer, sales manager of the Stephens-Adamson Mfg. Co. It consists of a dock, upon which is mounted a steel barge-unloading tower. A belt-conveyor leads to the center of the main conveyor bridge on which a shuttle conveyor set at right angles distributes to stock-pile storage. Tunnel conveyors under the stockpiles feed at right angles to a loading belt-conveyor which loads either cars or trucks for shipment. The ends of the reclaiming tunnel have been left open and later, if desired, arrangements can be made for loading at these points by extending the tunnel conveyors and providing for reversal of their drives.

In addition to the fact that the plant is of modern design and uses only the best of equipment it has an advantage over its competitors due to the fact that stored sand need not be rehandled for shipment but is automatically loaded by belt-conveyors. Storage and shipping operations are entirely independent of each other, and by the use of reclaiming tunnels shipments can be made under any conditions. Enough material can be stored to allow shipments to be made during the entire winter season. When weather or seasonal conditions make pumping impossible, the plant becomes purely a shipping plant and its full capacity is obtained with only 3 men. To fill a car or truck with sand all that is necessary is to throw a switch for power, open a valve in the tunnel and another in the loading bin.

The unloading dock was built far enough out into the river so that loaded barges can be moored alongside it even at the river's lowest stages. The dock is supported by 89 piles, each 60 ft. long, which

New sand-distributing plant of the St. Louis Material & Supply Co., St. Louis, Mo. Tower at right unloads from river barges. Shuttle distributing conveyor, reclaiming tunnel and loading conveyor at left.

Discharge of conveyor from tower to shuttle distributing conveyor.

were jetted for about half their length in the sand bottom of the river. Along the river side four clusters of 5 piles each were provided for tying up the barges. The floor of the dock is 33 ft. above zero water-level.

The unloading tower or gantry mounted on the dock is built entirely of structural steel and has an over-all height of 61½ ft. above the dock floor. The boom projecting over the river is 38 ft. long. The operating and control equipment is housed in an inclosure covered with Granite City corrugated-metal siding and roofing. The dock also supports the tail end of the main belt-conveyor, which has a steel-truss framework and is supported on three structural bents.

The head end of the main conveyor is supported at the center of the conveyor bridge, which consists of four clear-span structural trusses, each 125 ft. long, 7½ ft. wide, and 8 ft. high. These are supported on five steel cylinders, each 9 ft. in diameter and 55 ft. high. Their prime purpose is to support the bridge, but they can also be used for added storage if necessary. Each tank has a capacity of 167 tons.

Belt-feeder under tower hopper feeding belt-conveyor to plant.

The main tunnel below this bridge is also 500 ft. long and its top is at grade-level. The floor of the tunnel is 31½ ft. above the zero stage of the river. It is made of reinforced concrete and is 7 ft. wide and 7½ ft. high. The gates and belts within it are placed 1 ft. off center to give additional space on one side. The cross tunnel housing the loading conveyor is also made of reinforced concrete and is 85 ft. long.

The loading conveyor is mounted on a framework of channel beams and outside the tunnel is supported on four structural bents. The head end of the conveyor is supported on two loading bins consisting of steel cylinders 9 ft. in diameter and 30 ft. high.

The sand is dredged by contract and is delivered at the plant in the contractor's barges. Ordinarily an ample supply of sand is obtained less than 1 mi. upstream from the plant.

A 2½-cu. yd. Owen clam-shell bucket, running along the projecting boom of the steel unloading tower, lifts the sand from the barges anchored alongside the dock and discharges it into a 20-cu. yd. steel receiving hopper at the base of the tower. The bucket is operated by three Stephens-Adamson single-drum hoists mounted in an inclosure at the back of the tower. Each hoist is driven through a Falk speed-reducer and each has a G.E. magnetic brake. The two larger hoists, which close and lift the bucket, are driven by 60-hp. G.E. motors, and the smaller hoist, which moves the bucket back and forth along the boom, is driven by a 40-hp. G.E. motor.

A 36-in. Stephens-Adamson belt-feeder carries the material from the receiving hopper to the 30-in. main belt-conveyor which takes it to the center of the stock-piling bridge. This conveyor operates on 236½-ft. centers, and has a lift of 66 ft. and a belt speed of 400 ft. per min. It is gear-driven by a 50-hp. Westinghouse motor and the feeder is chain-driven from its tail pulley.

This conveyor can discharge directly to the ground below, into the center bridge tower, or on a shuttle conveyor which can discharge at any point along the 500-ft. length of the stock-pile tower. The shuttle conveyor is 30 in. wide and 210 ft. long center-to-center of the pulleys. It is carried on a structural-steel framework mounted on car wheels and runs on steel rails the entire length of the bridge. The shuttle is propelled by a capstan keyed to the head-pulley shaft, and the conveyor is driven by a 15-hp. Fairbanks-Morse line-start motor through a Falk speed-reducer and roller-chain. The motor and drive are mounted on the shuttle frame and power is secured through a cable which can be plugged in at a number of points along the bridge.

Sand is reclaimed from the towers or stock-piles through 45 openings in the top of the tunnel. The gates at these openings are of the company's own design and have automatic cut-off chutes operated by individual chain blocks. A sliding gate above each of these gates can be used if desired to help regulate the flow or to shut the gate entirely in case of repairs or when the gate is not to be used for some time.

(*Continued on page 35*)

Gravel Plant Employs Unusual Methods for Excavating and Handling

Geared-Head Motors Reduce Accident Hazards; "Black Top" Plant Operated in Conjunction

By CHARLES G. MILBURN
Milburn Machinery Co.

THE new sand and crushed-gravel plant of Brewer & Brewer Sons, Inc., of Chillicothe, O., is located about 5 mi. south of Chillicothe on a 200-acre farm purchased by the company some years ago with a view to carrying out the present development. The plant is built of reinforced concrete and steel throughout. Work was started April 1, 1932, and the plant was put into operation July 22, 1932. The plant has a capacity of over 125 tons per hr., but its average capacity over any considerable period is expected to be slightly less. A "black-top" plant is operated in conjunction with it.

The plant lies between the Norfolk & Western R. R. and Scioto River, which runs through the farm. The plant is approximately 300 ft. from the railroad and about 900 ft. from Scioto River and lies parallel to both. In spite of the fact that the gravel is excavated from the river, it was deemed practical to place the plant at its present location on an elevation approximately 18 ft. higher than the mean level of the river bank and thereby avoid the flood waters which have covered the lower land twice during the past fifteen years.

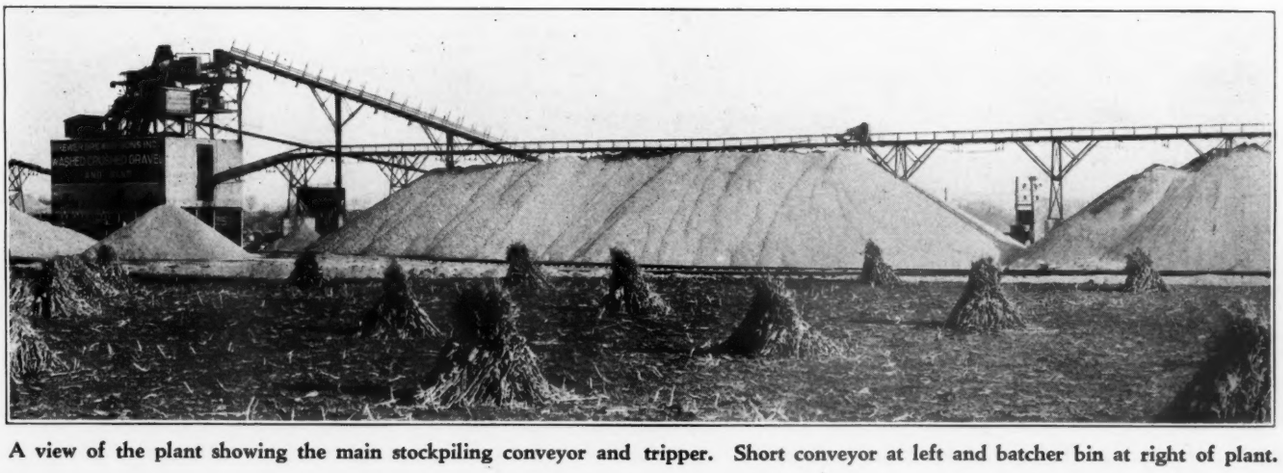
The product is reclaimed from a large bar of gravel in the river by means of an electrically-operated slack-line cableway of 1,000-ft. radius. The 1¼-cu. yd. Insley cableway bucket discharges the excavated material in a raw-material stock-pile immediately in front of the steel mast and as high as the mast will allow. This operation continues uninterrupted regardless of plant operation, as it was desired to provide a flexible reserve of raw dewatered material between the source and the plant. A Thomas hoist, driven by a 60-hp. G. E. motor, operates the cableway.

The use of a raw-material stock-pile has many advantages, as it is possible to maintain a stock ahead and allow 24-hr. independent operation at that point if desired. Repair periods and line shifting can be taken out without interrupting plant operation. Another advantage lies in having a large raw-material stock-pile of from 4,000 to 6,000 tons of material, which is free from water, and can be very easily handled with a shovel and later at the car dump and conveyor.

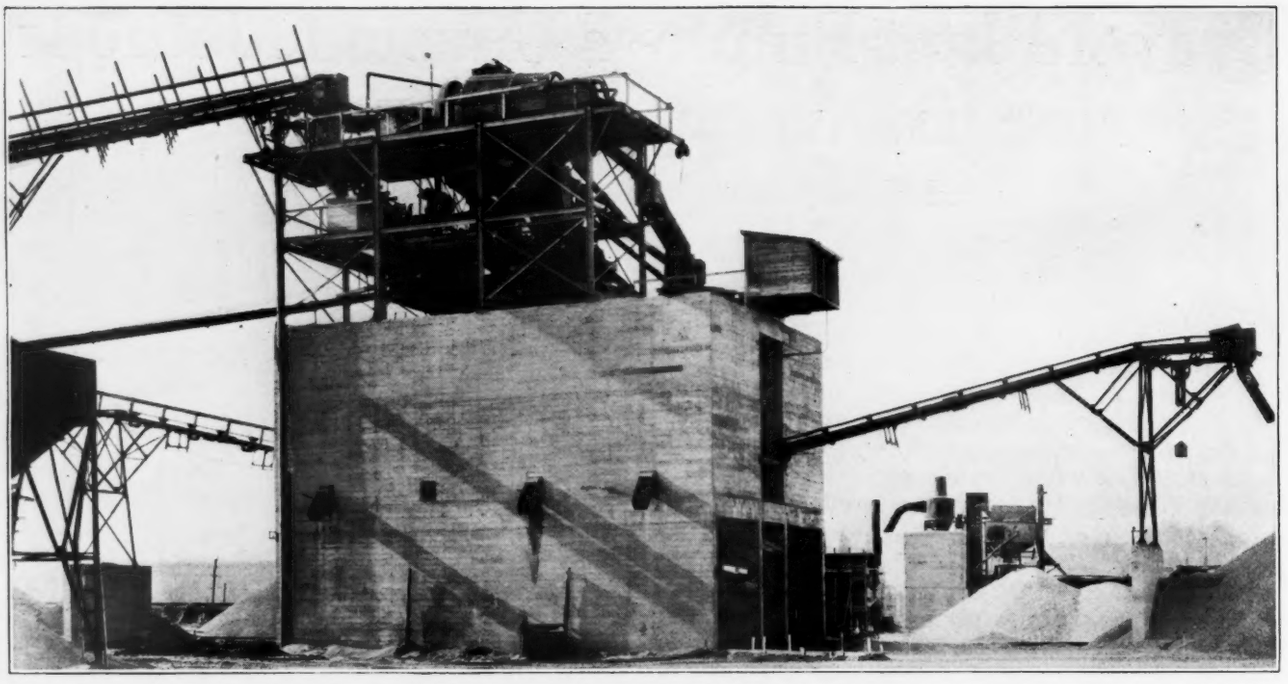
An Osgood 1-cu. yd. steam shovel is used at this raw-material stock-pile for reclaiming the material and loading it into a Western 10-cu. yd. side-dump standard-gage car drawn by a Plymouth 6-ton gasoline locomotive. The permanent track is practically straight, measuring about 850 ft. total length from the raw-material stock-pile to the car-dump and having a gradient of about 3 per cent.

After discharging the material at the car-dump, the locomotive and car return back by gravity for another load. It is a very simple matter to put 100 tons per hr. into the car-dump by this method and a peak of 150 tons per hr. can be reached. At first thought it would appear that this method of reclaiming and transportation is rather expensive, but it is possible to use a much smaller slack-line cableway (on double operation for peak-load requirements) and hold down the first cost and demand charge on peak-load electrical consumption during the day run. There is also the advantage of a large raw-material stock-pile and continuous operation of the plant regardless of any interruptions to the operation of the slack-line. The gasoline locomotive hauling the car requires no more fuel and oil to operate than a small pick-up truck.

The 20-cu. yd. concrete car-dump or hopper is



A view of the plant showing the main stockpiling conveyor and tripper. Short conveyor at left and batcher bin at right of plant.



Another plant view showing "black top" plant in background. Short conveyor with spout at right.

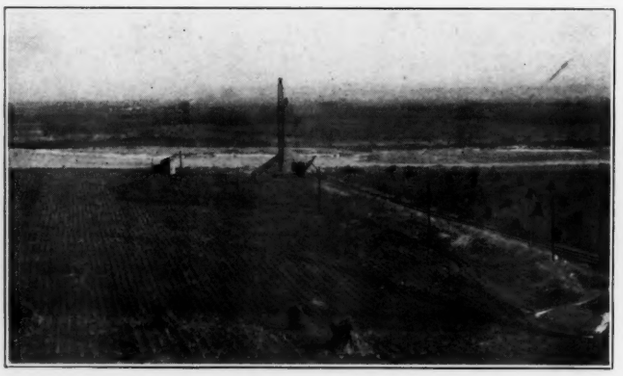
covered with a grill, made up of heavy railroad rails spaced to provide 10-in. square openings to reject oversized bowlders. The material is carried from the concrete hopper by a 24-in. apron feeder to a 3-in.-spaced perforated-plate grizzly placed on a 45-deg. angle. The oversize from this grizzly is reduced by a 10-in. Telsmith primary gyratory crusher which is at present set to crush to 3-in. size and under. The fine material passing through the grizzly and that reduced by the crusher is discharged on a 24-in. belt-conveyor running, at 300 ft. per min. on 265-ft. centers at an angle of about 18 deg., to the top of the screening plant. The crusher is driven through a short-center flat belt by a 25-hp. Allis-Chalmers motor mounted on a Kreitzer gravity-tension-type base. The feeder is belt-and-gear-driven from the crusher drive-shaft and has a friction clutch.

In the construction of this combination car-dump and crusher pit it was possible, owing to local conditions, to eliminate the usual "first-step" conveyor by elevating the top of the car-dump grating to a point approximately 8 ft. above the mean ground level or "datum" and placing the crusher foundation and crusher in what may be termed a depressed waterproof concrete box 22-ft. square and approximately 16 ft. below the mean ground level. A little painstaking work was required, but when completed, this eliminated an additional step conveyor, drives, motor, etc., thereby simplifying materially the operation at that end and eliminating certain "forever maintenance."

The main belt-conveyor is carried on an all-steel truss construction, the carrying rolls being equipped with Timken roller-bearings having triple-labyrinth grease seals. These carriers are of the renewable-shell type. The return idlers also have Timken bearings. The main belt take-up is of the gravity type. The proper safeguards and automatic back-up brakes for preventing return movement of the belt are also provided, together with motor control at either the top or the bottom.

In the design of the plant, in the arrangement and selection of the machinery, etc., the elimination, as much as possible, of exposed gears, drive chains, sprockets and superfluous open transmission machinery was one of the major aims. This was accomplished by using wherever possible

Crawler shovel loading from stock-pile to truck for shipment.



Looking from plant toward excavator and stock-pile at river bank.

The 40-in. gyratory crusher with feed spouts and belt drive.

The four-deck vibrating screen which sizes the crushed gravel.

"geared-head" motors. The 24-in. main conveyor, for instance, is driven by a 15-hp. Westinghouse "geared-head" motor, which requires only single-reduction gears in its connection to the main head-shaft of the conveyor, thereby making a very efficient, clean, trouble-proof drive. This and similar arrangements were used on the other units, such as screens, sand-tanks, conveyors, etc.

The gravel is discharged from the main conveyor into a "head-box" with a broad connecting flume. At this point a 6-in. stream of water is introduced. The material is carried through a 10-ft. flume to a Morrow 60-in. by 18-ft. combination scrubbing and sizing screen having a 78-in.-diameter sand-jacket. Except for the first 3 ft. of its length, the scrubbing section of the screen is perforated with about ⅜-in. holes. Special attention has been given to the angle of the sprays in the 6-in. (tapering to 3-in.) main water-line extending through the full length of the center of the screen. The sprays are arranged so that a continuous high-pressure supply of clean fresh water is directed at the proper points. The perforated scrubbing section removes soil, water, sand, etc., from the inner barrel, not allowing it to remain with the larger material passing to the larger-perforated sections.

This screen is fitted with steel protecting splash plates which, with the converging pans placed underneath and made of heavy steel very closely fitted and water-tight, force the correct passage of the different-sized materials to their respective bin chutes, eliminating the possibility of having mixed sizes in the wrong chutes, etc. Before the material is finally discharged into the bins, a dewatering arrangement (which is a part of the chute construction) removes the free water. The screen deck is 20 ft. above the top of the concrete bins, allowing sufficient head room for proper dewatering-chute arrangements and gravity flow to the different bins. The screen is driven by a 15-hp. Master geared-head motor through roller-chain and gears.

Water is obtained from a small stream at a distance of approximately 1,200 ft. from the plant. Existing elevations and the requirements of 1,200 gal. of water per min. at 20-lb. pressure requires a 10-in. discharge line with a 10-in. Cameron single-stage centrifugal pump, driven by a 50-hp. G. E.

The 60-in. by 18-ft. scrubbing and sizing screen with geared-head motor drive.

Geared-head motor drive of one of the two 36-in. sand-drag tanks.

The 24-in. main belt-conveyor which feeds from track hopper to the plant.

motor, at the source. The 10-in. line was laid full size for the entire distance and a "header" was run across the plant at the 52-ft. elevation with the necessary take-offs for different supply lines.

The gravel passing the main revolving screen is classified as No. 3 (minus 2-in.), No. 4 (minus 1-in.), pea gravel (minus ⅝-in.), and sand (minus ¼-in.). The oversized material (plus 2-in.) passes to a Telsmith 40-in. gyratory reduction crusher set at ⅞-in. opening. This discharges to a belt-bucket-elevator which runs on 40-ft. centers and empties on a 4-ft. by 8-ft. four-deck Telsmith vibrating screen that separates the crushed gravel into four grades. This vibrator is well supplied with high-pressure water-sprays. At its bottom is a separating mechanism for removing stone dust, as well as chips between ⅛-in. and 3/16-in. in size. Each of the crushed-gravel sizes passes a dewatering chute to the bin provided for it. The crusher is flat-belt-driven by a 50-hp. Allis-Chalmers motor mounted on a Kreitzer base, the vibrating screen is V-belt driven by a 5-hp. motor, and the bucket-elevator is driven through roller-chain from the revolving-screen drive-shaft and has a friction clutch.

The water, sand and soil, after leaving the main screen, are flumed through a wide chute having a perforated bottom plate and an adjustable control plate at a convenient point to allow taking off any desired amount of sand fines below ⅛-in. and fluming it to a 36-in. fine-sand drag-tank. The main volume passes on to another similar drag-tank producing concrete sand. The overflow from the concrete drag-tank is in turn reconnected to a flume leading to the fine-sand drag-tank, thereby making a closed circuit and allowing the fine-sand drag-tank to have every advantage of reclaiming the maximum amount of fines. Each of the sand-drags is driven by a 5-hp. Master geared-head motor through roller chain.

It is planned to install another reduction crusher, a Telsmith No. 32, a 12-in. belt-bucket-elevator set on 40-ft. centers, and another Telsmith triple-deck vibrating screen. This addition is to be made to allow excess round gravel minus 2 in. in size to be reduced to minus ⅝ in. independently of the other crushing operations. Many other plants in the state also are confronted with this problem due to the curtailment of construction work.

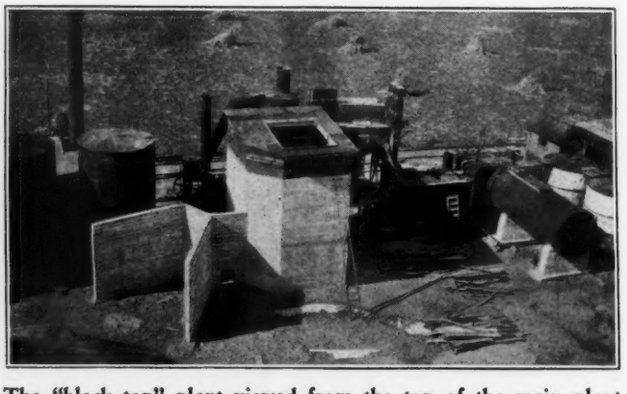
The concrete bins were built practically as two separate 4-bin units, with a space or aisle in the center to allow the operation of the two storage conveyors carrying materials in both directions from the plant. The "black-top" plant is just beyond and parallel to the railroad switch. This arrangement places crushed material, usually Nos. 4 and 6, within easy reach of the "black-top" plant, which has a capacity of 20 tons per hr. of hot-mixed or 10 tons per hr. of cold-mixed materials. Provisions are made for car-loading in the usual manner on the crushed-gravel side of the plant, as this class of material generally moves in car-load shipments. However, the north conveyor, extending out from the north end of the plant, can load cars with any material or mixture of materials from either side of the plant.

Inasmuch as highway-department specifications call for the placing of material in piles to allow the leeching of the free water and then rehandling it into the batcher, different-height openings were provided for allowing the concrete road gravel and sand to be discharged to three different stock-piles by gravity from the bins on the east side of the plant. The material is then handled by a Koehring gasoline crane fitted with a 1-cu. yd. Owen bucket into a Blaw-Knox 85-ton steel bin. This has a 3-compartment weighing batcher of sufficient capacity for a No. 27 paver, thereby keeping the trucks operating on batched material away from the driveways underneath the plant and avoiding interference with general jobbing operations.

The bin discharge gates in the center aisle are arranged so that it is possible to discharge on either of the conveyor belts any materials in any proportion going in either direction. The long storage conveyor, which is 18 in. wide and operates on 400-ft. centers, is fitted with a self-propelled traveling tripper which discharges from a height of 35 ft. to a 320-ft.-long stock-pile. This conveyor is driven by a 10-hp. Master geared-head motor through single-reduction gears. The short storage conveyor is also 18 in. wide, operates on 99-ft. centers, and is driven in the same manner by a 5-hp. motor. It is equipped with a swivel spout at its discharge end for loading a batcher bin but is at present being used for ground storage. The storage capacity with this conveyor and the other stor-

(*Continued on page 44*)

The locomotive and side-dump car which haul material to the screening plant.



The "black top" plant viewed from the top of the main plant building.

Progress in Gypsum Manufacture Points Way to Its Future Development

In Spite of Numerous Refinements, Great Opportunities for Advancement Lie Ahead

By O. A. ST. CLAIR

Former Chief Engineer, Beaver Products Co. and Atlantic Gypsum Products Co.

WHEN an industry grows from a few scattered, small, crude plants to one of major importance in less than twenty years it is only natural that it should excite interest. During the years of the growth of the gypsum industry thousands of average persons—the man and woman in the home—learned the word "gypsum," and yet it is doubtful if over one person in five hundred knows its meaning. This ratio must be different with regard to the term plaster of Paris, which to a considerable extent is a household phrase, and yet how many of these same people associate it with gypsum?

Why should a product which is so widely used in homes along with the almost universally known products, steel and cement, be so little known? True, in recent years some of the leading manufacturers of gypsum products have brought to the attention of architects and engineers the advantages and uses of these products, but the fact remains that in spite of all the advertising there are many potential ultimate consumers who have not yet been made familiar with these products. As far as one can see, the campaign for this education practically stopped with the beginning of the depression.

This article is not an attempt to answer the question how this educational program can be made complete but that program certainly can be furthered with advantage to the industry. The Western Electric Co. has issued a publication entitled *From the Far Corners of the Earth,* which illustrates steps in the preparation of materials which enter into the construction of the modern telephone. This is prepared in such a way that it is interesting and instructive, not alone to the engineer but to the layman. Something of the same idea might be advantageous to the gypsum industry.

But it is not so much the purpose of this article to discuss the knowledge of the general public with regard to the products of this industry as it is to enumerate some of the more recent improvements and to offer some suggestions wherein improvements of present-day methods seem feasible. Without going into too much detail it is hoped some of these suggestions may be of value in the continuance of the growth of the industry. Some of the suggestions appear at first thought to be foolish, wild, impractical, or even elementary, but it is still believed they may have some constructive value.

In the various steps in the process of gypsum manufacture there has been advancement of which the industry may be proud, and it is not the author's contention that no thought is now being given to further progress, but rather that there is still much room for advancement.

Mining.—Is it out of place to suggest that probably the time is not far distant when the open-quarry method of mining will be adopted much more generally than it has been? Instead of incurring the expense of sinking a shaft or driving a slope, of timbering, of handling thousands of tons of rock and dirt under handicapped conditions to obtain perhaps 80 per cent. of the deposit, and then in some instances come back later and rob the mine for the greater part of what remains under further handicapped conditions, why not adopt the quarry method more often?

No one who knows anything about the business will take the attitude that the shaft and slope methods are not absolutely necessary under many conditions, but with the development of stripping machinery the cost of removing overburden is much different from what it was twenty years ago. This development should cause those companies who have deposits where much timbering is required to support the roof, or where the depth of overburden is not too great, to give more serious thought to the method most economical under these conditions.

As evidence of progress in this operation it should be borne in mind that prior to 1925 the generally accepted method of digging gypsite throughout the southwest was the use of either slip or wheeled scrapers drawn by horses or tractors. About 1925 gasoline-powered drag-lines were adopted in a few instances and material savings in the cost of quarrying resulted.

Crushing.—Due to the developments made in the principles, capacities, and general efficiency of crushing machinery it is possible that not so much progress is likely to be made with respect to this operation in the gypsum industry as in some of the other processes. Nevertheless, it is altogether likely that the adaptation of these improvements to many comparatively modern plants will bear intelligent study.

If the size of the rock is not too great, and it is not necessary to reduce it too much before it goes to the grinding equipment, it is not at all unlikely that one crushing unit can be found which will do the work of a present primary and secondary unit and

at a considerable saving in power and maintenance. In fact, this method is in use in some instances. It is suggested for those plants where the rock does not exceed the so-called "man-size." Where power shovels are used to handle the rock in the mine or quarry, it is not likely to be practical.

Grinding.—From the well-known and almost universal method of millstone grinding with its accompanying conveyors and elevators, as well as small capacity per unit, to the mill with air-separation and the absence of elevators, and most of the conveyors, was a great advance. The millstone still has a place, but few are the engineers or operators who would recommend this method for raw grinding exclusively.

It must be borne in mind that all gypsum rock is not of the same hardness, nor can it all be ground with the same ease and wear and tear on the machinery. One type of grinding equipment is suitable for rock in one locality but entirely impractical for another. This was proved very conclusively a few years ago when a certain type of roller-mill was installed to grind Grand Rapids rock and was a decided failure. This same mill was later installed to grind Iowa rock and proved very satisfactory from all viewpoints—capacity, quality of product, horsepower and maintenance.

In these times of forced economies it may be a step in the right direction for some plants to discard some of their present equipment and supplant it with another type; and even if the argument that they do not have any money to send for new equipment be valid, it is very much to the point to reply that now is an opportune time to give consideration to such matters and to make lay-outs, so that when money becomes available for new equipment they will know the type of equipment they wish to install and approximately how much the installation will cost.

Grinding-Drying.—Manufacturers of gypsum products have been reluctant to experiment with the combined method of grinding and drying that is now on the market. Just why this hesitancy exists is not clear, when it is borne in mind that a large percentage of the gypsum-calcining plants in the country are throwing away from their kettle smoke-stacks gases which have a temperature, when they enter these stacks, of close to 900 deg. F.

Unless we are to believe that business in the future is to be less competitive than it has been in the past, here is a problem which certainly has the appearance of being worthy of continued study. In a few isolated cases a portion of these waste gases is put to use in the drying of rock or gypsite, but these instances are few and far between.

With the combination drying and grinding units which are now for sale and which are used to some extent in the Portland-cement industry there is a possibility of considerable economy. Perhaps an auxiliary furnace will be necessary, but the point is why waste 900-deg. gases if they can be reclaimed and made to do useful work and reduce the drying expense.

Calcining.—From the Cummer method of calcination, in which hot, dry rock was allowed to remain in a bin until calcination had taken place, to the yet popular calcining kettle, was an advance. Imagine the bin space necessary in some present-day plants to enable them to calcine by this method. From the kettle to the continuous rotary calciner with its difficulties was another forward step. At the present stage of development both the calcining kettle and the continuous rotary calciner have their places. However, with our development of mass production in so many industries where continuity of production is essential, it seems improbable that, because the rotary calciner has not been a success with all gypsum, the method can not be made practical. Just because the gypsum from some deposits builds up on the inside of the calciner, and because a variable percentage of fines produces a plaster of variable quality, the system must not be considered entirely impractical.

Mixing.—It is a pleasure to be around the modern mixing plant compared with such a plant of twenty-five years ago. The automatic scales, the stucco feeders that actually "feed" with a reliable degree of regularity, the modern sacking machines, dust-elimination systems—all these are the results of experimentation, engineering thought, and operating experience.

Devices to reduce the chances of error in the amount of retarder, etc., have been devised and used with encouraging success and the resulting elimination of errors in manufacture has been such that the greater portion of complaints arising from users of gypsum products, particularly wall plaster, come from errors on the part of the user himself. Continuous attempts to educate plasterers have not yet taught many of them to provide proper ventilation when using artificial means (mostly salamanders) to dry the plaster. Failure to wet down dry-wood lath or permitting too much dry air to blow against newly-applied plaster; the use of a dirty mortar-box or mechanical mixer—these, and numerous other causes of complaints, are practically beyond the power of the manufacturer to prevent, except in so far as he can assist in the education of the user.

The field of continuous mixing of prepared wall plaster has not been explored. It may, or may not, be a process which would have any practical value over the present batch system; in fact it is felt by many that quality is better controlled by the batch system. Nevertheless, the idea of continuous mixing is in line with the idea of progress in manufacture.

Warehousing.—It is a long time since a man pushed the first truck and it will be some time before the method will be entirely eliminated, but there certainly is room for an increase in the use of conveyors instead of hand trucks. There are also numerous cases where study would show that a motor truck to transport at one time a large number of bags to a loading platform, would be economical compared with the hand truck carrying its half-dozen bags.

These two methods have been adopted in the handling of block and board, respectively, but the handling of sacked goods is still done very largely by hand trucks, due in some instances, the writer believes, to the force of habit.

Bulk Storage.—Bulk storage of rock is not a new idea in itself but the methods employed have undergone great changes. There is a big gap between the old-style open storage, where the rock was exposed to rain, snow, freezing, and soot, and the covered storage and silo.

Bulk storage of stucco is more universal on a large scale than it was a few years ago, due to the necessity of having enough on hand to operate a board plant, block plant, or mixing department when the calcining department is closed or operating at reduced capacity.

With the more universal adoption of the practice of storing in bulk there have naturally come some problems. Unless the temperature of the stucco is reduced after it leaves the kettle and before it is put in storage, there is great danger that calcination will continue in storage with a resultant non-uniformly-setting plaster. This danger may be reduced by keeping down the amount of stucco put into each bin, but if it happens to be a very large bin it is a very simple thing for the operator to forget and fill the bin too full. So far the solution has been to cool the stucco or store it in relatively small quantities.

Much progress has been made in the method, or methods, used to reclaim crushed rock from storage. From the old method of uncertain hand-operated slide gates in spouts under a storage pile to the cut-off gates and to the power-driven feeder represents years of development. Now the development of the drag-line scraper, the power shovel, the mechanical loader, and the clam-shell bucket, have brought about a possibility of the elimination of the tunnel to a large degree. Certainly the tunnel will continue to be practical under some conditions, but there is a growing tendency to design and equip the bulk storages for rock so that the greater part of the work of reclamation will be done above ground, where everything is more accessible and where a greater percentage of the rock can be reclaimed at small cost.

The reclamation of stucco from bulk storage has likewise undergone many improvements. With care and some expense in the design of storage facilities the grief of uneven flow, "gushing," may be practically eliminated. The close-fitting screw, running inside a pipe, was a decided improvement over the spout and slide gate, but in those cases where there is a large "head" of stucco or where it is hot a drag-chain, operating in a channel and fitted with a shoe to regulate and retard the flow of the stucco, has eliminated much of the difficulty that existed with the previous methods.

Handling Equipment.—Whether the screw-conveyor will continue to be the accepted method of handling small-size rock, land plaster, and stucco is open to discussion. Experience has shown that the screw-conveyor is not the proper mechanism to handle crushed gypsum rock from which a large percentage of the fines has been removed, and which it is desirable to keep free from additional fines. If the rock is comparatively soft, 20 ft. of screw-conveyor will produce several percentages of objectionable fines; in other words the screw-conveyor acts as a grinder. A belt-conveyor seems to be the solution here.

The use of air as a conveying medium for land plaster and stucco has not met with the success that it has achieved in the cement industry. For a clean-cut installation and economy of space this system has decided advantages, but the writer's experience with it in the gypsum industry has not been entirely satisfactory. Where the distance through which the material to be conveyed is small, he believes the manufacturer does not claim any particular economy in its use; but, aside from this, there is the very objectionable feature in the danger of moisture in the air—a danger of which gypsum operators and engineers have a reasonable horror. A part of this fear may not be justified but a certain amount of it is.

One or two of the possible troubles expected by some gypsum men to occur if air were used as a conveyor did not materialize; *viz,* an aërating effect and an inability to handle stucco which had been subjected to the action of a tube-mill. In this latter case, however, it must be stated that the experience of the writer is limited to one installation and the quantity of material required to be handled did not exceed 20 tons per hr. Even with the existing objections to this method it is not unreasonable to believe that they may yet be overcome and the system made popular in the industry.

For handling calcined gypsum over a considerable distance it has been suggested that a belt-conveyor be used in place of a screw-conveyor. From the standpoint of the power required this suggestion has some merit, but in most cases a cooling of the stucco in transmission is desirable and certain amount of this change in temperature takes place in a screw-conveyor but not when the belt-conveyor system is used. There would also be the problem of taking care of the "spill" from the belt. This might be solved by a special box designed to reduce this spill to the minimum. The idea as a whole, however, appears to have more disadvantages than advantages.

With the development of high-speed unloaders, equipped with clam-shell buckets of sufficient weight and proper digging action, the speed with which gypsum rock can be removed from the holds of vessels, or from storage, has greatly reduced the cost per ton of this operation when compared with the cost when the equipment consisted of several slow-moving mast-and-gaff outfits, with buckets which were practical for handling coal or sand but entirely unsuitable for gypsum rock.

Dust Elimination.—To an outsider who has seen gypsum plants in operation for the last ten years or more it may appear that many of these plants, particularly those outside the cities and towns, have not made any imrovements in the field of dust elim-

ination. This is largely true of some plants; however, the tendency is in the opposite direction, especially in those plants located in cities or towns where ordinances limit the amount of free dust permissible.

Probably the main obstacle to this line of improvement has been the fact that the value of the reclaimed dust has been so small compared with the initial cost, operation, and upkeep of the equipment necessary for its reclamation. As the manufacturers began to appreciate the complaints of neighbors whose homes and farms were the recipients of the dust, and when some of the men of the industry became convinced that, while it may not be possible for a gypsum plant to be as spotless as some factories, its cleanliness could be greatly improved, then the matter of dust collection and elimination began to receive more attention.

The industry is learning that such things as the requirement of cleanliness and neatness from the owners tend toward the development of carefulness and pride in their work on the part of the employees. Cleanliness and orderliness—good housekeeping—are not appreciated by all workmen, but it is possible to make it influence the majority of them. After all a plant is in some respects like a human being; if it shows signs of being well groomed, it is a good advertisement for its owner.

Progress in dust elimination has reached the point where engineers who design the plants of the future, in fact those who alter the existing ones, will be required to make them as dustless as is practical, and that is considerable.

Architecture of Buildings.—There was a time not so many years ago when the architecture, particularly the exterior, of all gypsum plants was practically the same—rectangular with numerous "dog houses," spotted here and there over the roof, indicating the location of elevators. Now there is some attempt to make the appearance of these plants pleasing to the eye. In no place is this more evident than in the architecture of the plant office, which instead of being the plainest type of building is, in many instances, of attractive design and completely equipped.

Safety.—Let it be said to the credit of the industry that its leaders have supported the safety-first movement for years, particularly as applied to safeguarding moving machinery and the protection of workmen in bins or in mines where cave-ins are possible.

The amount of harm done to an individual by the inhalation of gypsum dust has been a debated question and doubtful statements are made that a certain amount of this dust is even beneficial. It is difficult to convince the average man that small particles of rock in his lungs are an asset. The dust elimination movement already referred to may well be classed as a safety movement.

Distribution.—The last few years have seen a marked change in the method of distribution of the finished products. From the original idea of having most of the manufacturing plants at the source of supply if possible, there has been a trend toward locating these plants in the large consuming centers. It is doubtful if the proof of the wisdom of this plan has yet been thoroughly demonstrated.

Local methods of distribution will vary. In New York City until two years ago, a large part of the plaster manufactured was delivered by lighters, owned by the gypsum manufacturers, to piers along the water-front, where the dealers' trucks picked it up and delivered it to the jobs. Suddenly one company who was out of the lighter radius decided to deliver direct to the job by truck. This made it necessary for the other companies to adopt the same plan. It goes without saying that with the growth of motor trucking the quantity of gypsum products shipped by this method has increased.

New Uses for Gypsum.—Just as the rubber manufacturers and other leading industries are continually in search of new uses for their products, so must the gypsum industry continue to find new outlets for its products. It seems logical to say that the more uses that may be developed for gypsum, the less disastrous to the industry will be declines in building.

The progress from the early uses of gypsum as a fertilizer and wall plaster to its additional uses as a retarder for Portland-cement manufacture, core for board (wall, lath, and plaster), material for partition tile and reinforced roof and floor tile, together with the numerous other purposes for which gypsum has been used, represents much thought and research and is evidence that some of those engaged in the business recognize the necessity for new uses. Certainly, if the capacity of present plants is to be utilized, even under normal times, it behooves the industry to bring forth new commodities.

Will the demand for gypsum board increase? The chances may be good for plaster lath, but will the same be true of wall-board? Is it not reasonable to think it possible that unless improvements are made it will go the way of its predecessor—Beaver Board? It may be argued that gypsum wall-board has more to commend it than Beaver Board, which is true, but this does not mean that some other product will not be developed and prove a strong competitor.

Is it beyond the realm of possibility to believe that it may be possible and practicable to treat wall-board so as greatly to increase its insulating qualities? It is now more fire retardant than some of its competitors, but why not make it also more sound-proof? Of the three new products added to the wall-board line of one company, one embodies a new principle of insulation.

For some reason the major part of the development work in connection with new products has been left in the hands of one company. Doubtless there are financial reasons for this condition, and yet the practice does not create interest among the employees of other companies and there is a question whether it is best for the industry as a whole. Would the electrical industry have reached its present position if one company had been left to do the development work for the entire industry?

Something of the policy of one relatively small company engaged in the manufacture of material-handling equipment is suggested. This company, prior to the break in the market in 1929, specialized in two or three types of equipment. After 1929 it decided that, contrary to the general practice, it would double its technical force, reduce its sales force, and concentrate on the development of new equipment in its line. The result has been that instead of being caught with the facilities to produce and sell only two or three pieces of equipment, it now has a much more complete line and a much wider field in which to sell.

Number of Plants.—As in other industries, there is an oversupply of plants in the gypsum industry in the United States. Prior to the 1929 *debâcle* it was the contention of many men in the business that the solution of this problem would be a consolidation of several of the smaller companies, with a reduction of overhead and the possibility of closing certain plants where there was more than one belonging to the consolidated companies in a given locality. Another suggestion was that one or more of the larger concerns should acquire some of the smaller plants and close those which were not necessary. Any legal aspects of these suggestions were secondary in so far as the ideas were concerned.

Attempts at consolidation were made with little success. One company values its property at a higher figure than another company, with whom negotiations are being carried on, thinks it is worth; one set of officers and stockholders refuses to agree to a consolidation if they have to take a secondary position in the management; and so the matter dies.

One fact the recent depression brought out is that often it is the smaller company that can best weather such a storm. A company whose cost of "management" is small, which has few (if any) outstanding notes or bonds, with little stock on which to pay dividends and no heavy depreciation or investment charges has in many instances found it less of a struggle to keep going than some of its larger competitors.

Obsolescence may take care of a part of this surplus of plants. Others will continue to make barely sufficient profits to justify operation.

The Future.—When the large increase in the consumption of gypsum products began about fifteen years ago, there were those who each year forecast that the following year could not be as good as the year just ending. There are those who now claim that building will never see such years as were experienced just prior to the crash, and there are those who hold to the view that the present is only a "lull," not a stop. However that may be, there will certainly be periods in which a considerable amount of building will be done, and the fewer of these periods the more necessary it will be that gypsum manufacturers have as many outlets as possible, and that they be willing to dispose of their products at as low a price as possible, consistent with a reasonable profit.

A recent survey claims to show that 90 per cent. of the people of this country are unable, even under normal business conditions, to support a dwelling costing upward of $5,000 and that 75 per cent. of the workers of the country are in the class whose annual income is $2,500 or less. The claim is made that the bulk of work for builders for the next two years will be to provide housing for this latter class. If this prophecy is correct, the gypsum industry can easily figure the nature of its business for the immediate future, unless it develops something new.

St. Louis Material *(From page 25)*

The two tunnel conveyors are 24 in. wide and 230 ft. center-to-center. Each is driven by a 15-hp. Fairbanks-Morse motor through roller-chain and a Falk speed-reducer. Both discharge at the center of the stock-pile tunnel to the inclined loading conveyor, which is set at right angles to them. This conveyor is 30 in. wide and 193 ft. center-to-center, has a total lift of 50¼ ft., and is gear-driven by a 40-hp. Westinghouse motor. Valves in the roof of the cross tunnel allow sand to be taken direct from the main conveyor through the center silo when the river equipment is in operation and from the center of the stock-pile. The tail end of the loading conveyor is in a sump in the reclaiming tunnel.

The loading conveyor discharges through a selective split chute to either of or both the two loading silos, each of which has a live loading capacity of about 25 tons. Drop-chute gates on each side of the bins allow quick loading of cars on one side and of trucks on the other. Car shipments are weighed on a 250,000-lb. Howe track-scale on one of the two loading tracks alongside the silos, and space has been left for a similar scale on the other track should it become necessary to use this also for car loading. Each track has storage capacity for 10 empty cars above the loading point and the same number of loaded cars below.

The entire plant, with the exception of the timber piles and dock, is of fireproof concrete-and-steel construction. The entire unloading dock, including the feeder, was designed, furnished and erected by the Stephens-Adamson Mfg. Co. The remainder of the plant was erected by a local contractor. This tower was designed to handle a 3-cu. yd. bucket, but, by using one of only 2½-cu. yd. capacity, longer and more economical service is expected. Most of the conveyor idlers, drive gears, sprockets and chain were furnished by the Link-Belt Co. Tru-lay cable and Crosby cable clamps are used on the unloading tower. Crouse-Hinds conduit is used throughout.

The electrical control of the plant is also worthy of mention. The eight 440-v. motors used have a total of 295 hp. The tower-hoist motors are operated by G.E. drum-switch controllers and Square D safety switches. A small steel-frame corrugated-metal building near the dock houses the main switches, transformers, etc. Each conveyor has an individual local control switch. An interlock makes it impossible to operate the tunnel conveyors unless the loading conveyor is in operation.

Developing Formulae for Determining the "Correct" Lime Content of Cement

By DR. HANS KÜHL
Director, Institute of Cement Technology, Berlin Technical College, Berlin-Lichterfelde, Germany

EVEN in the early days of the cement industry it was known that the strength properties of a Portland cement improve with increasing lime content of the cement, but that there is an upper lime limit beyond which expansion and cracking (unsoundness) sets in. W. Michaelis gave this phenomenon its first scientific formulation with the rule that the "lime ratio" *(hydraulischer Modul; module d'hydraulicité)*, that is, the quotient of the percentage content of the cement in lime and the sum of the percentages for silica, alumina and iron oxide, $\left(\frac{CaO}{SiO_2 + Al_2O_3 + Fe_2O_3}\right)$, should be approximately 2.0 in good Portland cements. To-day we know that the lime ratio in the case of the supercements highest in silica can go as high as 2.4.

The evaluation of Portland cements by the lime ratio has been adopted by cement technologists the world over, although in many countries with some modifications. Thus, sometimes magnesia, and sometimes the alkalies as well, are reckoned with the lime. An essentially different manner of computation has come into use only in the United States and in France, where the concept of the "hydraulic index" *(indice d'hydraulicité)*, by which is understood the quotient, $\frac{SiO_2 + Al_2O_3}{CaO}$, has been developed. This way of contrasting lime and hydraulic factors leaves the iron oxide out of consideration, apparently because at that time it was considered immaterial. Yet it is interesting that R. K. Meade [1] recommends calculation with the lime ratio and thus harks back to Michaelis' old form of expression.

Practical experience teaches, however, that the highest lime content a cement plant can attain is dependent on many circumstances that are not expressed in the lime ratio. I shall disregard entirely the fact that numerous technological considerations, such as the fineness of grinding and the thoroughness of burning, are also of influence here. I wish, rather, to confine myself to purely chemical considerations and to point out, for example, that cements rich in silica can contain more lime than cements rich in alumina and high-alumina cements still more lime than cements rich in iron oxide.

On the basis of this find many years ago I classified the cements according to the proportion of silica to the sesquioxides, and was led to the formation of the idea of the "silica ratio" (*Silikatmodul; module silicique*) [2], by which I understand the quotient of the cement's silica content and its content in sesquioxides $\left(\frac{SiO_2}{Al_2O_3 + Fe_2O_3}\right)$. Later I elaborated this procedure still further, and introduced alongside the concept of the silica ratio the concept of the "alumina ratio," [3] by which I understand the proportion of alumina to iron oxide $\left(\frac{Al_2O_3}{Fe_2O_3}\right)$. I was driven to this extension of my procedure when it became apparent that in the cements low in silica great differences exist in respect to capacity for combining with lime as the proportion of alumina to iron oxide varies.

The necessity for classifying the cements according to their content of silica has also been plainly perceived in the United States. But in this classification the iron oxide was again disregarded, for in the "index of activity" (according to R. K. Meade) the silica is opposed only to the alumina and from the percentages of these two components the quotient $\frac{SiO_2}{Al_2O_3}$ is derived.

Thus we see that the technological evaluation of the composition of Portland cements in the United States and in Germany has developed in accordance with two different systems, which are essentially distinguished by the consideration of the iron oxide as follows:

United States

Hydraulic index $\frac{SiO_2 + Al_2O_3}{CaO}$

Index of activity $\frac{SiO_2}{Al_2O_3}$

Germany

Lime ratio (Hydraulischer Modul)	$\frac{CaO}{SiO_2 + Al_2O_3 + Fe_2O_3}$
Silica ratio (Silikatmodul)	$\frac{SiO_2}{Al_2O_3 + Fe_2O_3}$
Alumina ratio (Tonerdemodul)	$\frac{Al_2O_3}{Fe_2O_3}$

I shall not seek to establish which of the two systems deserves preference, but shall only briefly point out here that the German classification

[1] R. K. Meade, Portland Cement, p. 39 (Easton, Pa., 1926).

[2] Protokolle d. Verhandlungen d. Vereins Deutscher Porlandzement-Fabrikanten, 1913, p. 405.

is especially well adapted to instruction in cement chemistry and for getting a first general view of the amount and importance of the individual components of cement, for in most Portland cements of normal composition all three quotients,

$$\frac{CaO}{SiO_2 + Al_2O_3 + Fe_2O_3}, \quad \frac{SiO_2}{Al_2O_3 + Fe_2O_3} \text{ and } \frac{Al_2O_3}{Fe_2O_3},$$

have very nearly the same value, 2.

It is clear that all these formulæ lack exact scientific foundation, for they all proceed from the (naturally false) assumption that the principal components of cement are equivalent one to another; thus, for example, that each of the three hydraulic factors—silica, alumina and iron oxide—has the capacity for combining with the same amount of lime. If, in spite of this obvious shortcoming, these rough formulæ are widely used for computations at cement plants the world over even to-day, it is because science has not yet succeeded in making available to the industry a well-founded "cement formula," which not only takes the scientific facts into account but also stands in accord with practical experiences. This is all the more astonishing as the search for such a "correct" cement formula goes back almost four decades.

In the year 1897 Spencer W. Newberry and M. B. Newberry reported in the Society of Chemical Industry in New York [4] that, according to their findings, the silica in Portland cement has the capacity of combining with 3 molecules of lime, the alumina with 2 molecules of lime and the iron oxide likewise with 2 molecules. Thus, leaving aside the secondary components, the authors reached the following formula for the most probable composition of a Portland cement with maximum lime content:

$$x(3CaO.SiO_2) + y(2CaO.Al_2O_3) + z(2CaO.Fe_2O_3)$$

Unfortunately the two Newberrys thought it necessary to advance a simplification in this formula and to leave out the iron oxide as inconsiderable. They accordingly recommended to the industry that the formula:

$$x(3CaO.SiO_2) + y(2CaO.Al_2O_3)$$

be taken as a basis for the highest possible lime content of Portland cements, and calculated from this the value:

$$CaO_{(max)} = 2.8\ SiO_2 + 1.1\ Al_2O_3$$

for the maximum quantity of lime that a Portland cement can absorb in the presence of given quantities of silica and alumina.

The proposal of the Newberrys met with lively opposition from cement technologists [5], for it was demonstrated that, under the practical conditions of the time, unsound cements were produced if Newberry's rule was followed. Only an exchange of opinions between S. B. Newberry and W. Michaelis Sr.[6] restored peace; Newberry's formula was recognized by Michaelis as a theoretical limiting formula.

Later S. B. Newberry [7] simplified his limiting formula further by reducing the coëfficient for the proportion by weight between alumina and lime from 1.1 to 1.0 and expressing anew the maximum admissible amount of lime through the formula:

$$CaO_{(max)} = 2.8\ SiO_2 + 1.0\ Al_2O_3.$$

From this equation we obtain by a slight mathematical manipulation the expression for

Newberry's "lime factor": $\dfrac{CaO - Al_2O_3}{SiO_2} = 2.8.$

For practical use Newberry intends the "lime factor" to apply in the same way as Michaelis had prescribed for the lime ratio. The lime factor is not to be taken as a fixed quantity, but the choice of the lime factor must conform to the silica content of the cement. In cements commercially produced the lime factor lies generally near 2.7, often even near 2.6. But through these restrictions Newberry's formula completely lost its original character of derivation from scientific considerations. The lime factor in just that way turned into an empirical computing quantity like the "lime ratio" of Michaelis, or like the formulæ for the "hydraulic index" and the "index of activity" current in the United States.

Edwin C. Eckel [8] was the first to return to the scientific basis created by two Newberrys, when he introduced the idea of the "cementation index" to the cement industry. Eckel assumed that lime can be equivalently represented by magnesia. He also took into account the content of cements in iron oxide and thus obtained for the maximum amount of lime *and* magnesia that a Portland cement can contain the following relation:

$$(CaO + 1.4\ MgO)_{(max)} = 2.8\ SiO_2 + 1.1\ Al_2O_3 + 0.7\ Fe_2O_3.$$

From this is derived a cement's "cementation index":

$$C.I. = \frac{2.8\ SiO_2 + 1.1\ Al_2O_3 + 0.7\ Fe_2O3}{CaO + 1.4\ MgO}.$$

Eckel's cementation index constituted for a long time the best formulation for the lime content of Portland cements. It was superseded when, through the researches of Rankin and his associates at the Geophysical Laboratory in Washington and through the labors of the subsequent period, it became recognized that the assumptions from which the Newberry's had proceeded, and which Eckel also had adopted with some refinements, do not correspond to reality.

Actually, not only has it been shown that magnesia does not take part in the formation of the clinker minerals but is contained free in Portland cement,[9] but we have also had to adopt new ideas about the compounds into which alumina and iron

[3] *Zement*, 1926, p. 637. At first I called this quotient the "iron ratio," but later chose the expression "aluminar ratio," following a suggestion of Messrs. Spindel and Hess.

[4] *Journal of the Society of Chemical Industries*, 1897, p. 887.

[5] W. Michaelis, Jr., *Cement and Engineering News*, 1900; *Tonindustrie Zeitung*, 1900, p. 2,025. M. B. Newberry, *Cement and Engineering News*, 1900; *Tonindustrie Zeitung*, 1900, p. 2,074. W. Michaelis, Jr., *Cement and Engineering News*, 1900; *Tonindustrie Zeitung*, 1901, p. 17. W. Michaelis, Sr., *Tonindustrie Zeitung*, 1901, p. 18. L. Erdmember, *Tonindustries Zeitung*, 1901, p. 1,549.

[6] *Tonindustrie-Zeitung*, 1901, p. 2,013.

[7] *Cement Age*, July, 1905, p. 75.

[8] Edwin C. Eckel, Cements Limes and Plasters, 2d ed., p. 174 (New York, 1922).

[9] W. C. Hansen, Portland Cement Assn. Fellowship, Paper 18; *Journal of American Chemical Society, 50*, p. 3,081 (1928). W. C. Hansen, Portland Cement Assn. Fellowship, Paper 22. *Bureau of Standards Journal of Research*, January, 1930, R. T. 132.

oxide enter with lime. In high-lime systems containing no iron oxide, alumina forms the compound $3CaO.Al_2O_3$ [10]; in high-lime systems containing no alumina, iron oxide forms the compound $2CaO.Fe_2O_3$ [11]; high-lime systems alumina *and* iron oxide form with one another the compound $4CaO.Al_2O_3.Fe_2O_3$.[12]

It is clear that here we have all the premises for computing, in the same way as Newberry had previously attempted, that maximum quantity of lime which can be combined by a Portland cement with a determined content of silica, alumina, and iron oxide. Such computations have indeed been made repeatedly, not only in America [13] but also in Germany [14], yet they have not everywhere found the desired adoption in the practical operation of cement factories, because they lacked convenient form of expression clear even to the ordinary laboratory worker.

Affairs stood thus when, in March, 1930, I took up anew the attempt to construct a formula which would clearly express a cement's relative content in lime and would also give the practical operator a rule for the best utilization of his raw materials. I realized that I must set up a relation, as Newberry and Eckel had previously sought to do, between the highest possible amount of lime with which given hydraulic factors can be combined and that amount of lime which, in a determined cement, is actually combined with the hydraulic factors. But I considered further that it is just as important to find for this relation *an expressive, self-explanatory name,* and thus I developed the concept of the *"lime satiation ratio" (Kalksättigungsgrad),* which I defined as the percentage proportion of the actual lime content of a cement in relation to the highest possible lime content with which a given amount of silica, alumina and iron oxide can be combined [15]:

$$\text{L. S. R.} = \frac{100\ CaO}{2.8\ SiO_2 + 1.65\ Al_2O_3 + 0.7\ Fe_2O_3}.$$

How greatly the industry required such an expression for the lime content of cements, founded on scientific considerations but likewise universally comprehensible, is probably most clearly demonstrated by the fact that a few months later and, as I believe, entirely independent of my work, the very same idea of the lime satiation ratio was developed in the United States by S. Rordam.[16] Even if Rordam's formulation differs from mine in some details, the fundamental thought is nevertheless plainly the same. For cements containing more alumina than iron oxide Rordam arrives at the following formula for the "lime satiation ratio":

$$\text{L. S. R.} = \frac{\text{actual lime}}{\text{maximum lime}} = \frac{\text{actual lime}}{CaO - 0.7\ SO_3} = \frac{\text{actual lime}}{2.8\ SiO_2 + 1.65\ Al_2O_3 + 0.35\ Fe_2O_3}$$

Rordam's formula differs from mine by the following three variations:

(1) Rordam refers the lime satiation not to the number 100, but to the number 1. This is entirely immaterial for the comparison of the two formulæ and for their practical application.

(2) Rordam takes the sulphuric-anhydride content of the cement also into account. I ignore this, because I am of the opinion that it is more correct to leave all secondary components of cement, to which belong the magnesia and the alkalies as well as the sulphuric anhydride, out of consideration so long as we do not know how these components participate in the construction of the clinker. We shall probably come closest to the truth if, for a general point of view, we assume that sulphuric anhydride on the one hand and the alkalies on the other counterbalance one another in their practical effect.

(3) The iron oxide appears in my formula with the factor 0.7, in Rordam's formula with the factor 0.35. Here we have to deal with a difference of fundamental significance, which I must discuss in somewhat greater detail.

First must be explained how it happens at all that there are apparently *two* possibilities of expressing the "maximum" amount of lime with which given amounts of silica, alumina and iron oxide can be combined. The answer is derived from the way in which the problem is put.

The question I had proposed was what amount of lime, *in general* and without regard to the course of the reaction as it actually takes place in the mass during burning, can be combined by given hydraulic factors. The answer to this could only be that the silica has the power of combining with 3 molecules, the alumina likewise with 3 molecules and the iron oxide with 2 molecules of lime: This, then, yielded for the maximum quantity of lime the expression I chose:

$$CaO_{(max)} = 2.8\ SiO_2 + 1.65\ Al_2O_3 + 0.7\ Fe_2O_3.$$

A system with this maximum lime content can be realized if the three materials—tricalcium silicate, tricalcium aluminate and dicalcium ferrite—are produced separately and intimately mixed with one another in the approximate proportion corresponding to the occurrence of silica, alumina and iron oxide in Portland cement.

Against such a "synthetically" produced cement with highest lime content it can be objected, however, that it can not be obtained from calcareous and argillaceous materials through a direct burning process. In such a system using natural raw materials the Brownmiller compound $4CaO.Al_2O_3.Fe_2O_3$ forms in place of tricalcium silicate and dicalcium ferrite, in accordance with the equation:

$$3CaO.Al_2O_3 + 2CaO.Fe_2O_3 = 4CaO.Al_2O_3.Fe_2O_3 + CaO.$$

[10] E. S. Shepherd, G. A. Rankin and F. E. Wright, *American Journal of Science, 28,* 293 (1910).
[11] Sosman and Merwin, *Journal of Washington Academic Sciences, 6,* 532 (1916).
[12] W. C. Hansen, L. T. Brownmiller and R. H. Bogue, Portland Cement Assn. Fellowship, Paper 13; *Journal of American Chemical Society, 50,* 396 (1928).
[13] R. H. Bogue, Portland Cement Assn. Fellowship, Paper 21; Analytical Edition, *Industrial and Engineering Chemistry,* 1, 192 (October, 1929).
[14] A. Guttmann and F. Gille, *Zement,* 1929, p. 571.
[15] H. Kühl, *Tonindustrie Zeitung,* 1930, p. 391.
[16] S. Rordam, *Rock Products,* June 7, 1930, p. 82.

This fact must be taken into account if the question asked is what amount of lime can be combined by the three hydraulic factors *in industrial burning of cement.* In that case we obtain with Rordam the following equation for the maximum lime content of Portland cements produced under practical conditions [17]:

$$CaO_{(max)} = 2.8\ SiO_2 + 1.65\ Al_2O_3 + 0.35\ Fe_2O_3.$$

I should have no hesitation in giving Rordam's formula preference over mine if it actually gave the correct answer to the question of the maximum lime content of industrial Portland cements, but this answer it does not give, for it leaves out of consideration those reservations which are conditioned by the incongruent fusing of tricalcium silicate and tricalcium aluminate. Even Rordam's formula, therefore, represents only a limiting case, which can not be realized in practice even from a raw mix prepared with extreme thoroughness, or even from a fused mass of Portland cement!

If matters stand thus—and that they do, I shall show in what follows—then it appears to me more correct *to establish as the maximum amount of lime that quantity which can be combined with the hydraulic factors at an actual maximum, rather than a quantity which neither is a real maximum nor represents an attainable value of reality.*

To prove that even Rordam's formula leads to values for the maximum lime content which can not be attained in practice even in the most favorable circumstances, I rely upon two scientific investigations carried out very recently in my laboratory by my co-workers E. Spohn [18] and S. Solacolu.[19] Unfortunately, it is impossible to go into the two works exhaustively in the scope of this article, because they are too extensive for that; I must confine myself to a short *resumé* and refer interested readers to the original reports, which have just been published in the German journal *Zement,* for all details.

Both investigations proceed from the thought that it is not possible to ascertain by theoretical consideration the quantity of lime which can be combined at a maximum by the hydraulic factors in the practical manufacture of Portland cement, but that only practical experiment can be decisive on this point. Accordingly, the conditions of burning in modern technology were reproduced as completely as possible, and each investigator determined the amount of lime which can actually be combined under the conditions prevailing in the operation of a rotary-kiln cement plant, if a raw mix is so finely and completely ground that the limit of the reaction is conditioned only by the chemical composition and no longer by the degree of fineness of the components. The nature of the conditions for this end, and the details of the procedure necessary so that the test results could be reproduced satisfactorily, were determined by preliminary tests.

It was clear that, for the solution of the problem presented, it was necessary to pay special attention to the capacity of the iron oxide for combining with lime and to the iron oxide's effect on the sintering process. Spohn and Solacolu could not, therefore, confine their labors to the 3-component system, lime-silica-alumina, but the investigations had to be planned on a much broader scale including the iron oxide.

The almost infinitely great range opened up, if the values of the silica ratio and of the alumina ratio are varied between widely separated limits, can be reduced at once by confining the investigation to quite definite values of the *alumina ratio* typical for the system. As such we are concerned with:

(a) Systems free from iron oxide,

(b) Systems with iron-oxide content within the range of normal Portland cements,

(c) Systems in which alumina and iron oxide are present in equivalent amounts,

(d) Systems with iron-oxide content (in equivalents) greater than their alumina content.

For each of these four cases the *silica ratio* was varied between the values ∞ and 0 and in this manner they determined how the capacity for combining with lime changes if we pass step by step from systems quite rich in silica to systems containing as hydraulic factors only alumina and iron oxide.

In carrying out the tests the investigators used mainly raw meals having a lime satiation ratio (after Kühl) of 100 or even a little more—that is, raw meals in which it had to be remembered that a small part of the lime they contained would remain uncombined. The raw meals were burned under test conditions reproducing commercial practice as exactly as possible, and in the clinker produced the unused lime was determined as "free lime" qualitatively according to White [20] and quantitatively according to Emley.[21] The investigation led to the following results:

1. Systems without Iron Oxide.—As silica and alumina each can combine with 3 molecules of lime, the limit of combination with lime for systems from these three substances is theoretically given by the connecting line $3CaO.SiO_2$—$3CaO.Al_2O_3$ in Rankin's diagram. Melts lying at any point along this connecting line will always primarily liberate free lime (CaO), it is true; but if the cooling takes place *so slowly* that equilibrium prevails during the cooling process, the primarily liberated calcium oxide must be reabsorbed and the cooled system must at the end consist actually of tricalcium silicate and tricalcium aluminate. (We shall not discuss here the subsequent dissociation of the tricalcium silicate at low temperatures observed by W. Michaelis [22] and S. L. Meyers.[23]) Rankin himself knew that this theoretical requirement is not fulfilled in prac-

[17] If the cement contains (in equivalents) more iron oxide than alumina, the equation accordingly reads:

$$CaO_{(max)} = 2.8\ SiO_2 + 1.1\ Al_2O_3 + 0.7\ Fe_2O_3.$$

This case does not come into question for normal Portland cements; it will not be discussed until later.

[18] E. Spohn, The Lime Limit of Portland Cement and the Technical Properties of Its Clinker Minerals; dissertation, Berlin-Charlottenburg, 1932. *Zement,* 21:702-706, 717-723, 731-736, Dec. 15, 22 and 29, 1932.

[19] S. Solacolu, The Utilization of Rankin's Diagram CaO-SiO_2-Al_2O_3 in the Practice of Cement Burning; dissertation, Berlin-Charlottenburg, 1932. *Zement,* 22:17-22 and 33-38, Jan. 12 and 19, 1933.

[20] White, *Journal of English Industrial Chemistry,* 1909, I, p. 5.

[21] Emley, *Transactions of American Ceramic Society,* 1915, p. 720. Lerch and Bogue, Portland Cement Assn. Fellowship, Paper 2 (1926).

[22] W. Michaelis, Prot. Verhandl, Ver. Deutsch. Portl. Cem. Fabr. 1906, p. 143.

[23] *Rock Products,* 1930, April 12, p. 78.

tice [24]; what E. Spohn sought to ascertain through his experimental investigation was just how far practice falls short of theory.

There was little prospect of being able to determine the direction and course of a boundary curve for the maximum combination with lime if the investigation were restricted to that narrow field corresponding to Portland cement in Rankin's diagram. To obtain, on the contrary, a survey as broad as possible, Spohn studied the limit of combination with lime in the whole field between the tricalcium silicate and the tricalcium aluminate and

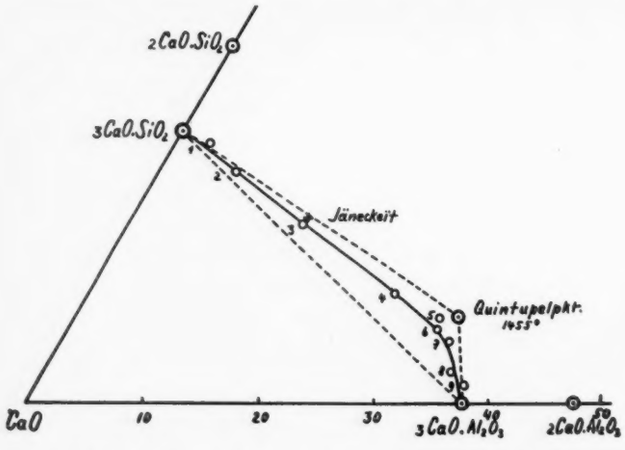


Fig. 1. Limit of combination with lime in cements without iron oxide (Spohn). [Janeckeit=Jaeneckeite; Quintupelpkt.=Quintuple point.]

established the points of maximum combination with lime in this entire region on nine radii issuing from the lime corner (Fig. 1).

Fig. 1, in which the quintuple point 1,455 deg. of Rankin's diagram is also indicated to facilitate comparison, shows the results Spohn reached. We see that the curve of maximum combination with lime moves between the points of the two tricompounds with a great bulge in the proximity of the quintuple point, 1,455 deg.

To anyone who knows Rankin's diagram the curve offers at first no particular surprise, for the general course of the curve was foreseen. Nevertheless, Spohn was able to reach very interesting conclusions that are of great significance to practice.

From theoretical considerations connected with the course of the curve of lime satiation Spohn reached the conclusion, in fact, that in the industrial sintering of Portland-cement raw meals containing no iron oxide *the same state of equilibrium is reached as if the mass had been fused first and then cooled down to the sintering temperature.* Only in the cooling of the sintered clinker are equilibria no longer reached, inasmuch as the reabsorption along the arc from quintuple point 1,470 deg. to quintuple point 1,455 deg., which is to be expected from the course of the curve in Rankin's diagram (Fig. 2) fails to appear. *In commercial clinker from raw meal without iron oxide we are accordingly dealing with an equilibrium congealed at the sintering temperature, and the limit of combination with lime moves, in the region that concerns us, from point 3CaO.SiO$_2$ to the quintuple point 1,470 deg.* (Fig. 2).

With the line of lime satiation thus established in Rankin's diagram, it appears as a remarkable arrangement of change that this boundary line beginning at the point of the tricalcium silicate points with its prolongation almost exactly to the (in reality non-existent) compound 2CaO.Al$_2$O$_3$. In the range of all those systems which can be designated as iron-oxide-free Portland cements in the widest sense the limit of the practically-attainable lime satiation is therefore given by the formula:

$$x(3CaO.SiO_2) + y(2CaO.Al_2O_3).$$

From this we obtain for the practically-attainable maximum of the lime content:

$$CaO_{(max)} = 2.8SiO_2 + 1.1\ Al_2O_3.$$

II. Systems with the Iron-Oxide Content of the Portland Cements.—If we disregarded their secondary components—magnesia, alkalies and sulphuric anhydride—the Portland cements form a section from the 4-component system, lime-silica-alumina-iron oxide. As this system has not yet been fully studied, S. Solacolu was obliged to confine his investigation to a determined cross-section through it, for otherwise the problem would have become quite boundless. Solacolu achieved this simplification by fixing, for all the systems which he investigated, a constant iron-oxide content of 5 per cent. This value is, of course, somewhat higher than that corresponding to the average of Portland cements, but it must be introduced in this quantity

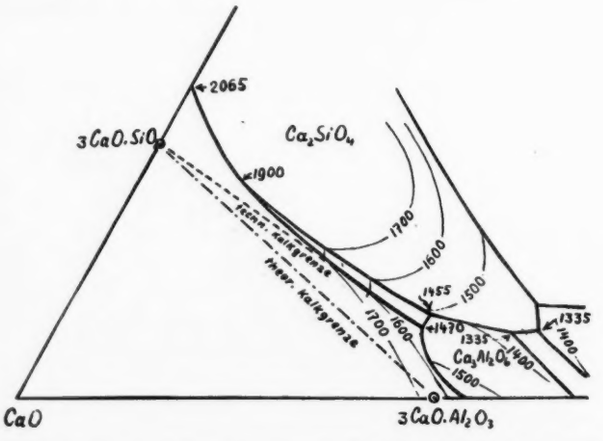


Fig. 2. Position of the lime limit in Rankin's diagram (Spohn). [techn. Kalkgrenze=practical lime limit; theor. Kalkgrenze=theoretical lime limit.]

to obtain an appreciable interval in contrast to the system studied by Spohn. Otherwise the plan of procedure is very similar to Spohn's, since Solacolu also varied the proportion between silica and alumina within the wide limits and determined the limit of the practically-attainable combination with lime for the whole range between the cements very rich in silica and those without silica.

[24] G. A. Rankin, *Zeitschr. anorg. Chem.* 1915, p. 289.

The distribution of hydraulic factors studied by Solacolu can be seen from Table I, in which the proportions by weight of silica, alumina and iron oxide are indicated. Within each of the nine groups the limit of combination with lime was ascertained experimentally. The results were represented graphically by entering them in the tetrahedron of the 4-component system. The principle of this presentation can be gathered from Fig. 3.

As in all cements investigated, there are 5 parts by weight of iron oxide to 25 parts by weight of silica plus alumina, all the cements lie in a triangle, of which one angle coincides with the CaO-angle of the tetrahedron and the other two angles are determined by the points P and P'.[25] Aside from the fact that by this arrangement Solacolu was able to represent his results in a plane triangle although working with 4 components, he had above all the possibility of carrying over to the surface he was working on—that is, the triangle CaO-P-P'—with a high degree of probability the conjugation lines of Rankin's diagram forming the base of the tetrahedron. This is illustrated schematically in Fig. 3. For the total result of Solacolu's work this translation proved extremely fruitful; but unfortunately we can not go into any discussion of this point.

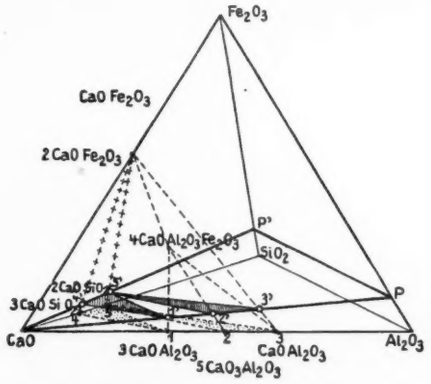


Fig. 3. Position of the iron-oxide-bearing Portland cements in the four-compartment tetrahedron (Solacolu).

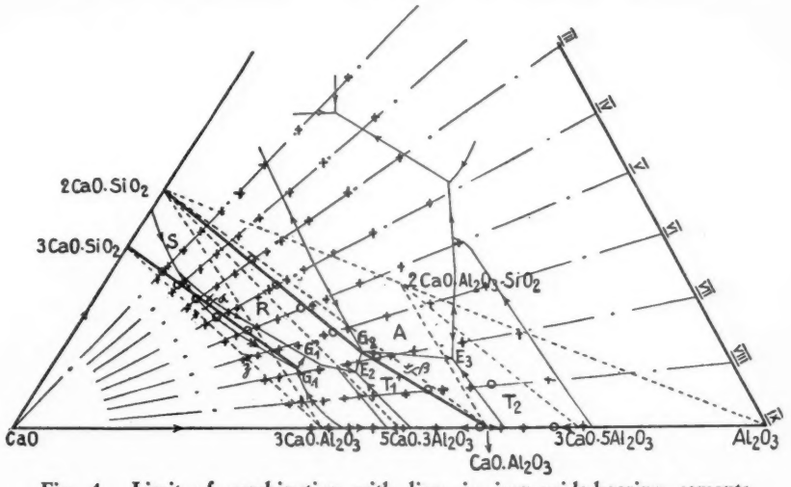


Fig. 4. Limit of combination with lime in iron-oxide-bearing cements (Solacolu).

The results Solacolu obtained are summarized in Fig. 4. This illustration again contains details which can only be understood in the setting of the complete work. We confine ourselves to consideration of the straight line from point $3CaO.SiO_2$ to point G_1, as it represents the limit of lime satiation in the range of the iron-oxide-bearing Portland cements.

If we compare Solacolu's findings for the iron-oxide-bearing coments (in the order of Portland cements) with Spohn's for cements without iron oxide, we find in general no appreciable difference! In the system which Solacolu studied the limit of combination with lime is again represented by a straight line, which begins at point $3CaO.SiO_2$ and in its prolongation strikes the $CaO\text{-}Al_2O_3$ side of the triangle at a point corresponding closely to the (hypothetical) compound $2CaO.Al_2O_3$. From this it is plain that systems involving the iron-oxide content of Portland cements also reach equilibrium during sintering and that, in them also, we have to do with equilibria congealed at sintering.

With complete analogy existing thus far between Spohn's and Solacolu's results, it remains to be considered, for the comprehension by means of a formula of the lime satiation possible in practice that in systems rich in lime, iron oxide, according to the consistent findings of numerous investigators, combines with 2 molecules of lime. Accordingly, the practically-attainable lime satiation of iron-oxide-bearing systems in the order of the Portland cements is given by the formula:

$$x(3CaO.SiO_2) + y(2CaO.Al_2O_3) + z(2CaO.Fe_2O_3).$$

From this we obtain for the practically attainable maximum of the lime content

$$\mathbf{CaO_{(max)} = 2.8\ SiO_2 + 1.1\ Al_2O_3 + 0.7\ Fe_2O_3}$$

III. Systems with Equivalent Amounts of Alumina and Iron Oxide.—If alumina and iron oxide are present in equivalent amounts, they form with lime the Brownmiller compound $4CaO.Al_2O_3.Fe_2O_3$ and there exists no possibility of the formation of simple calcium aluminate and calcium ferrite. Along with the silicates of calcium cements of this sort can thus contain only the Brownmiller compound and, as this melts congruently, variations from the equilibrium can be occasioned only by the incongruent fusing of the tricalcium silicate. To what extent disturbances of this sort occur in such cements with equivalent amounts of alumina and iron oxide was determined by E. Spohn by means of an investigation conducted along exactly the same lines as have already been described for the two cases earlier discussed.

In Fig. 5 the results Spohn obtained are represented in a triangle, at the ends of which we are to suppose silica, lime and sesqui-oxides ($Al_2O_3 + Fe_2O_3$). Points 1 to 8 represent the composition of the raw mixes which Spohn studied. The limit of combination with lime lies, as the figure shows, on a straight line, which has its origin at point 3CaO. SiO and moves in the direction of point $4CaO.Al_2O_3$.

[25] The triangle CaO-P-P' can be regarded as a ternary diagram $CaO\text{-}Al_2O_3\text{-}SiO_2$; its corners correspond to 100 per cent. CaO, 83.33 per cent. Al_2O_3, and 83.33 per cent. SiO_2.

Fe_2O_3. A variation is observed only in the vicinity of tricalcium silicate; it is, as Spohn shows, occasioned by the circumstance that, on account of the very slight amount of the sintering melts, the combination with lime proceeds too slowly.

From the chemical point of view, Fig. 5 tells us that in systems containing lime and alumina in equivalent amounts a sintering melt of the composition of the Brownmiller compound is formed, and that the tricalcium aluminate completely crystallizes out of this melt. An interruption of the course of the reaction by the incongruent fusing of tricalcium silicate does not, therefore, occur, and the cements with the highest lime content consist actually only of tricalcium silicate and the Brownmiller compound, corresponding to the formula:

$$x(3CaO.SiO_2) + y(4CaO.Al_2O_3.Fe_2O_3).$$

If for calculation we here divide the Brownmiller compound into (hypothetical) dicalcium aluminate and dicalcium ferrite, we can also express the formula:

$$x(3CaO.SiO_2) + y(2CaO.Al_2O_3) + y(2CaO.Fe_2O_3).$$

From this we get for the practically-attainable maximum of the lime content the expression:

$$\mathbf{CaO_{(max)} = 2.8\ SiO_2 + 1.1\ Al_2O_3 + 0.7\ Fe_2O_3}$$

IV. Systems Containing More Iron Oxide than Alumina (in Equivalents.)—If we increase the iron-oxide content of cements beyond the amount equivalent to the alumina, we come into the range of the ferrous cements *(Erzzemente)*. The compounds richest in lime, which can possibly be formed in the practical production of these cements

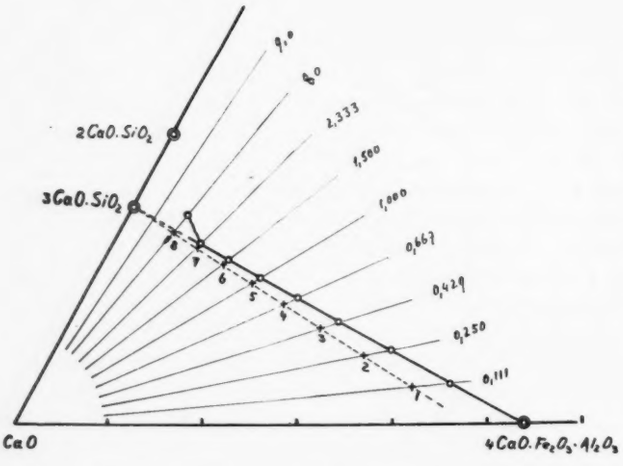


Fig. 5. Limit of combination with lime in cements with equivalent amount of iron oxide and alumina (Spohn).

from a raw mix low in alumina or without alumina, are, according to the consistent opinion of all investigators, tricalcium silicate, dicalcium ferrite and the Brownmiller compound. It is to be ascertained whether these compounds are actually formed under the conditions of industrial cement-burning and whether in these cements also, as in those of the foregoing groups, the limit of combination with lime in practice corresponds to the simple requirements of theory.

As regards the cements without alumina (or quite low in alumina), I showed some time ago [26] that in their case tricalcium silicate is formed along with a fused mass which can only consist of dicalcium ferrite. This conclusion has recently been substantiated by still more complete means by Q. Sestini and L. Santarelli [27]. The Italian investigators were able to show that, from raw mixes containing only silica, iron oxide and lime and with lime content corresponding to the system $x(3CaO.SiO_2) + y(2CaO.Fe_2O_3)$, clinker, which contains no free lime, is formed at 1,440 deg.

The range between the "Brownmiller" cements and the ferrous cements without alumina has not been studied by us, because there was no necessity for it. As the Brownmiller compound in fact forms with dicalcium ferrite a series of isomorphic mixtures, and as all the melting points in this series lie at about the same height [28], nothing is changed from the physical-chemical point of view over the ends of the series, in which the system contains, along with lime and silica, either only iron oxide or alumina and iron oxide in equivalent amounts. The composition of all ferrous cements with highest lime content is therefore given by the formula:

$$x(3CaO.SiO_2) + y(4CaO.Al_2O_3.Fe_2O_3) + Z(2CaO.Fe_2O_3)$$

or otherwise written:

$$x(3CaO.SiO_2) + y'(2CaO.Al_2O_3) + Z'(2CaO.Fe_2O_3).$$

From this we obtain again for the practically attainable maximum of lime even for cements with very high content of iron oxide the same formula:

$$\mathbf{CaO_{(max)} = 2.8\ SiO_2 + 1.1\ Al_2O_3 + 0.7\ Fe_2O_3}$$

Discussion.—A consideration of all kinds of Portland cements with all possible variations in the proportion of silica-alumina-iron oxide has shown us that, while the course of reaction in the sintering process does indeed follow quite different laws according as the cement contains alumina or iron oxide (reckoned in equivalents) in excess, the amount of lime which in practical operation can be combined at a maximum by given amounts of the hydraulic factors can nevertheless in all cases be expressed by one and the same formula; viz., the equation:

$$CaO_{(max)} = 2.8\ SiO_2 + 1.1\ Al_2O_3 + 0.7\ Fe_2O_3$$

Here we have a remarkable turn of chance, inasmuch as the numerical coëfficients 1.1 for alumina and 0.7 for iron oxide are determined stoichiometrically only on the part of the cements high in iron oxide, while their value on the part of the cements high in alumina is yielded purely empirically from the course of the boundary curve between the regions of free lime and of tricalcium silicate in Rankin's diagram.

From the fact that even with the most varied proportions of the hydraulic factors the composition of the cements highest in lime which can be

[26] H. Kühl, Prot. Verhandl. Verein Deutsch. Portl. Cem. Fabr. 1921, p. 121.
[27] Q. Sestini and L. Santarelli, Protok. des Züricher Kongresses des I. A. T. M. (Trans. of the Zurich Congress of the I. A. T. M.), I, p. 679 (Zurich, September, 1931).
[28] W. C. Hansen, L. T. Brownmiller and R. H. Bogue, Portland Cement Assn. Fellowship, Paper 13; *Journal of American Chemical Society, 50*, p. 396 (1928). S. Solacolu, *Zement*, 1932, p. 301.

Table I—VARIATION OF THE SILICA RATIO

Group	Proportion SiO_2:Al_2O_3:Fe_2O_3	Silica Ratio
I	20 : 5 : 5	2.00
II	17.5 : 7.5 : 5	1.40
III	15 : 10 : 5	1.00
IV	12.5 : 12.5 : 5	0.71
V	10 : 15 : 5	0.50
VI	7.5 : 17.5 : 5	0.33
VII	5 : 20 : 5	0.20
VIII	2.5 : 22.5 : 5	0.09
IX	0 : 25 : 5	0.00

produced in practice always finds its expression in the formula:

$x(3CaO.SiO_2) + y(2CaO.Al_2O_3) + z(2CaO.Fe_2O_3)$.

it is also comprehensible to us that the assumption of a dicalcium aluminate plays so great a *rôle* in the literature on cement, although this compound in reality has no existence at all.

Newberry worked with this compound as with a self-evident material, and Eckel derived from it the idea of the cementation index; Wetzel [29] defined the connecting line $3CaO.SiO_2$—$2CaO.Al_2O_3$ on the basis of microscopic observations on plane sections as the boundary line of free lime in Portland cement; and Jaenecke [30] would indeed have found at a determined point on Wetzel's line [31] the chemical compound $8CaO.2SiO_2.Al_2O_3$ [$= 2.(3CaO.SiO_2) + (2CaOA.l_2O_3)$].

Even if all these observations and calculations proceeded from incorrect ideas, they nevertheless contain a particle of truth. Although the compound $2CaO.Al_2O_3$ does not in reality exist, its introduction as a *computing quantity* for determining the maximum amount of lime that a Portland cement can contain is indispensable. It is obtained in the case of the cements high in iron oxide as a (hypothetical) component of the Brownmiller compound $4CaO.Al_2O_3.Fe_2O_3$, and in the case of the cements high in alumina it is the point toward which aims the radius that begins at the tricalcium silicate point and which marks off the region of the maximum combination with lime from that of free lime.

If our discussion was mainly begun to decide whether Rordam's formula or mine deserves preference for the lime satiation ratio of Portland cement, we come now to the conclusion, that both formulæ lose significance for the practical manufacture of cement in contrast to the finding that neither the one nor the other represents the lime satiation which can actually be attained in practical operation. The finding that all cements, whatever their content in silica, alumina and iron oxide be, are satisfied by a single formula with regard to their combining of lime will be of supreme interest for the operator. I find in this conclusion the verification of the assertion I advanced some years ago [32], that for every Portland cement there is a "correct" content of lime, and that this "correct" lime content is expressed by the very formula:

$$CaO_{(max)} = 2.8\ SiO_2 + 1.1\ Al_2O_3 + 0.7\ Fe_2O_3$$

Since this formula has now found its experimental and scientific basis and thereby proved its superlative importance for the technology of Portland cement, I believe that the lime content it defines should be regarded as a characteristic of all Portland cements and this lime content designated as *standard lime.* For any given Portland cement the *lime standard (L. St.)* is given, then, as the percentage of its actual lime content in proportion to its "standard lime," according to the formula:

$$\text{L. St.} = 100. \frac{\text{Actual Lime}}{\text{Standard Lime}} = \frac{\text{Actual Lime}}{\text{100 CaO}}$$

$$\overline{2.8SiO_2 + 1.1\ Al_2O_3 + 0.7\ Fe_2O_3}$$

Every cement plant burning a well-prepared raw meal in the modern kiln can attain lime standard 100. If its product falls short of lime standard 100, attempts must be made, by improving the preparation or the burning process, to come closer to this figure. If its product exceeds lime standard 100, it will be a danger signal that the product is approaching the point of unsoundness.

[29] E. Wetzel, Protok. Verh. Vereins Deutsch. Portl. Cem. Fabr. 1911, p. 217, and 1913, p. 347.
[30] E. Jænecke, *Zeitschr. anorg. Chem.*, *73*, p. 206 (1911).
[31] H. Kühl and W. Knothe, Die Chemie der Hydr. Bindemittel, p. 167 (Leipzig, 1915).
[32] H. Kühl, *Zement*, 1929, p. 833.

Lime Production in 1932

The sales of lime in 1932 by producers in the United States amounted to 1,956,000 short tons, valued at $12,108,000, according to preliminary figures furnished by lime manufacturers. This is a decrease of 28 per cent. in quantity and 35 per cent. in value compared with sales of 2,707,614 tons valued at $18,674,913 in 1931, and follows a decrease of 20 per cent. in quantity and 27 per cent. in value in 1931 compared with 1930. The average unit value per ton in 1932 was $6.19; in 1931 it was $6.90.

Small demand and lower prices were generally reported for all classes of lime with decreases in output ranging from 10 per cent. to 75 per cent. or more for producing companies. Few companies reported increases, and several plants were shut the entire year.

Sales of lime in 1932 for construction are esti-

LIME SOLD BY THE PRODUCERS IN THE UNITED STATES IN 1931 AND 1932

State	1931			1932 (estimated)		
	Total Lime		Hydrated Lime	Total Lime		Hydrated Lime
	Short Tons	*Value*	(*Short Tons*)	*Short Tons*	*Value*	(*Short Tons*)
Ohio	656,441	$4,007,004	426,144	477,000	$2,479,000	286,000
Penna	497,258	3,378,088	183,795	374,000	2,410,000	155,000
Missouri	224,416	1,481,240	87,389	180,000	1,082,000	76,000
Tennessee	113,268	566,694	32,168	104,000	454,000	27,000
West Va	170,420	985,687	47,515	85,000	446,000	34,000
Virginia	100,659	654,665	36,544	78,000	437,000	26,000
Illinois	96,105	718,952	28,169	76,000	547,000	17,100
Alabama	137,423	823,437	19,754	75,000	370,000	16,000
Mass	123,607	1,108,036	25,782	64,000	466,000	24,000
Indiana	81,925	502,232	43,534	64,000	342,000	34,000
Michigan	46,716	334,015	8,777	42,000	301,000	10,400
Texas	45,553	384,392	24,265	35,000	286,000	23,000
Wisconsin	42,621	372,244	8,397	31,000	230,000	7,000
New York	49,574	412,351	20,673	29,000	229,000	11,500
Vermont	30,226	271,417	8,659	29,000	202,000	6,700
California	41,371	389,696	12,727	27,000	246,000	9,000
Maryland	36,445	268,148	24,928	25,000	160,000	16,000
Maine	28,157	250,028	(*a*)	23,000	183,000	(*a*)
Washington	20,619	215,033	(*a*)	17,400	175,000	(*a*)
Arizona	22,567	222,785	(*a*)	14,000	146,000	(*a*)
Other	142,243	1,328,769	80,046	106,600	917,000	62,300
Totals	2,707,614	18,674,913	1,119,266	1,956,000	12,108,000	841,000

(*a*) Included under "Other."

mated at 666,000 tons, compared with 947,085 tons in 1931, a decrease of 30 per cent. This followed a decrease of 21 per cent. in 1931 from the 1930 production.

Sales of lime for chemical uses are estimated at 1,070,000 tons, a decrease of 27 per cent. from 1931 (1,463,217 tons). In 1931 there was a decrease of 20 per cent. from the 1930 sales.

The sales of lime for agricultural use are estimated at 220,000 tons, a decrease of 26 per cent. in 1932 from 1931 (297,312 tons). A decrease of 13 per cent. occurred in 1931 from the 1930 figures.

All the states producing lime showed decreases from the 1931 production ranging from 2 to 66 per cent. in quantity and 7 to 63 per cent. in value. In the majority of states the percentage decrease in output was less than the decrease in value.

Ohio, the leading state in the production of lime, had an estimated output in 1932 of 477,000 tons, valued at $2,479,000, a decrease of 27 per cent. in quantity and 38 per cent. in value. Ohio is also the largest producer of hydrated lime, the greater part of which is used in construction. The estimated sales of hydrated lime in Ohio in 1932 were 286,000 tons, valued at $1,298,000, representing decreases of 33 per cent. in quantity and 45 per cent. in value from 1931.

Brewer & Brewer (*From page 30*)

age arrangements totals about 24,000 tons, making it feasible to close the plant for periods with the stock-piles full, not to mention the advantages of the arrangement for meeting peak seasonal demands.

The arrangements are such that the crane has a convenient reach to load from stock-piles either into cars on the railroad siding or into trucks on the opposite side, and it was to provide ample space for stock-piles that the main feeding conveyor from the car-dump was placed on an angle of 45 deg. from the north-and-south center-line. A Winslow 20-ton truck-scale at the office near the plant is used for weighing truck shipments. Deliveries are made in a fleet of 25 trucks owned by the company.

It is gratifying to know that every arrangement worked out superior to its first ratings with man power, connected motor horsepower and electricity consumption per ton extremely low. From 10 to 13 men are required to operate the plant at capacity. A total of 245 hp. is installed in the plant and the power factor is in excess of 85. Owing to the extreme flexibility of this plant, no material that has not been very easily supplied has so far been demanded.

The plant was designed by and built under the direction of C. G. Milburn of the Milburn Machinery Co., Columbus, O. The rotary screen, sand-tanks and steel structure above the bin were furnished by the Morrow Mfg. Co., Wellston, O. The Columbus Conveyor Co., Columbus, O., furnished the belt-conveyors, the bucket-elevator, the steel conveyor galleries and the apron feeder. Timken roller-bearings are used on both carrier and return idlers. The conveyor belting was furnished by the Boston Woven Hose & Rubber Co. Binks spray nozzles are used for washing the material. Macwhyte wire rope is used on the slack-line cableway.

The main office of Brewer & Brewer Sons, Inc., is at 81 W. Water St., Chillicothe, O. The company's officers are: W. O. Brewer, president; P. P. Brewer, vice-president; and F. H. Brewer, secretary.

ATTENDANCE AT THE CONVENTIONS

Detroit, Jan. 16-20, 1933

TOTAL ATTENDANCE

	Crushed-Stone	Sand and Gravel	Ready Mixed Concrete	Net Totals
Producing companies' representatives	94	109	35	217
Companies represented	(46)	(74)	(32)	(152)
Trade publication representatives	8	11	12	13
Publications represented	(2)	(5)	(5)	(6)
Guests	63	44	36	106
Ladies present	(18)	(21)	(21)	(54)
Association employees	6	3	3	9
Equipment-makers' representatives	87	91	48	176
Companies represented	(34)	(40)	(26)	(69)
Totals	258	258	134	521

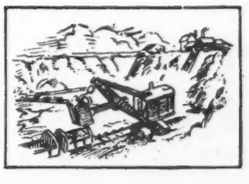
LARGE GROUPS IN ATTENDANCE

Producers	Representatives Present
Crushed-Stone Convention—	
General Crushed Stone Co.	13
Dolomite Products Co.	6
C. C. Beam, Inc.	4
LeRoy Lime & Crushed Stone Co.	4
(Seven companies had 3 representatives each; 11 had 2 each; and 24 had 1 each.)	
Sand-and-Gravel Convention—	
American Aggregates Corp.	8
Eastern Rock Products, Inc.	7
Lincoln Sand & Gravel Co.	4
(Four companies had 3 representatives each; 11 had 2 each; and 56 had 1 each.)	
Ready-Mixed-Concrete Convention—	
(No large groups; 3 companies had 2 representatives each, and 29 had 1 each.)	
Equipment Makers and Publications	
Joint Exposition—	
American Manganese Steel Co.	7
Bucyrus-Erie Co.	6
Thew Shovel Co.	6
Burton Explosives, Inc.	5
E. I. du Pont de Nemours & Co.	5
Jaeger Machine Co.	5
Link-Belt Co.	5
Robins Conveying Belt Co.	5
Simplicity Engineering Co.	5
Allis-Chalmers Mfg. Co.	4
Blaw-Knox Co.	4
Crucible Steel Co.	4
Marion Steam Shovel Co.	4
Nordberg Mfg. Co.	4
Pit and Quarry	4
Rock Products	4
Sauerman Bros., Inc.	4
W. S. Tyler Co.	4
(Fourteen companies had 3 representatives each; 12 had 2 each; and 25 had 1 each.)	

MEN OF THE INDUSTRY

H. St. G. T. CARMICHAEL

MR. CARMICHAEL has, since Jan. 1, 1921, been General Manager in charge of the Production Department of the Kentucky Rock Asphalt Co., one of the largest producers of natural rock asphalt in the United States. Under him the company's annual productive capacity at its Kyrock, Ky., plant has been increased from about 40,000 tons to over 300,000 tons. After his graduation from Washington and Lee University in 1899 Mr. Carmichael was for many years prominently identified with large railroad-engineering and construction projects. His present plant organization, recruited largely from Kentucky mountaineers, is widely known for its efficiency.



Personal Mention

W. J. Wallin of Amsterdam, N. Y., together with other stockholders of the Wallbuck Stone Quarry at Whitehall, recently purchased the interest of Cady Buckley in the quarry. Mr. Buckley had been in charge of operations since they started last July. No changes are expected to be made.

H. A. Sutermeister, of the Sutermeister Stone Co., Kansas City, Mo., was recently elected executive secretary of the Home Building Exhibit Trade Assn. of that city.

Fred R. Richardson, district engineer of the Portland Cement Assn., was elected president of the Engineering Council of Utah at a recent meeting.

Richard A. Dittmar, superintendent of the Hudson, N. Y., plant of the Universal Atlas Cement Co., was elected president of the Columbia Council of the Boy Scouts of America at the annual dinner held recently.

Eugene J. Letendre has sold his sand and gravel business in Amoskeag, N. H., to the firm of Vogel & Hadley, thus ending a price war which had resulted in gravel being sold at prices below the cost of production.

H. G. Nevins, who is well known to the building industry of Chicago, has been employed to represent the Dewey Portland Cement Co. in the Greater Chicago District. In addition to selling Dewey portland cement, Mr. Nevins will also promote the sale of Dewey's two special products, Dewey masons' cement, a bricklayers' cement, and Dewey Super cement, a rapid-hardening, waterproof portland cement.

Charles Boettcher II, grandson of Charles Boettcher and son of Claude K. Boettcher, respectively president and vice-president of the Ideal Cement Co., Denver, Colo., was kidnapped from his home in that city several weeks ago and at the time of going to press was still missing. All efforts of the police and private agencies have had no results. Mr. Boettcher is a broker and, although not directly connected with the cement company, has a considerable interest in it.

Mark Beeman was appointed manager of the Washington office of the Portland Cement Assn., effective Feb. 1. His predecessor, A. C. Toner, is on an indefinite leave of absence due to ill health. Before becoming associated with the P. C. A. Mr. Beeman had been secretary of the Concrete Reinforcing Steel Institute since its founding.

Capt. R. J. Stewart was elected president of the Pioneer Sand Co., St. Joseph, Mo., at the recent annual meeting of the stockholders. He succeeded the late Bernard Feeney, Sr. Others elected were: A. L. Lehr, vice-president; I. A. Vant, treasurer, and C. J. Feeney, secretary.

Obituary

W. Vance Brown, president of the Asheville Mica Co. and the English Richmond Mica Corp., died recently at his home in Asheville, N. C., at the age of 68.

William E. McComas, district engineer for the Portland Cement Assn., died at his home in Germantown, Pa., on Jan. 17.

Duke F. Stewart, former chairman of the board of directors of the Stewart-Peck Sand Co., died recently in Kansas City of a heart attack. He retired from active business in 1918 and devoted much of his time to his notable collection of rare books and curios from all parts of the world.

Carl D. Bradley, 22-month-old son of Fred V. N. Bradley, purchasing agent of the Michigan Limestone & Chemical Co., was found dead in his bed recently. He apparently died from strangulation caused by his sleeping garments tightening about his neck. The child was the grandson of the late Carl D. Bradley, former head of the Michigan Limestone & Chemical Co. and the Bradley Transportation line.

Henry Furst, 69, chairman of the board of directors of the Monon Stone Co., Bloomington, Ind., died recently in Wilmette, Ill. He entered the stone business more than 22 yr. ago in Chicago. He is survived by a widow and a daughter.

William Johnson, 90, pioneer operator who for more than 50 yr. was actively engaged in the limestone industry, died recently at Bloomington, Ind., after an illness of several months. In 1892 he founded the Chicago-Bloomington Limestone Co., which is now the Bloomington Limestone Co., and of which his son, Harry Johnson, is president.

Clinton J. Minch, 37, an employee of the McGrath Sand & Gravel Co. at its plant in Chillicothe, Ill., was killed recently as he, together with other workers, was engaged in dismantling an old timber storage-bin. A quantity of solidly-packed gravel in the bin gave way and suffocated and crushed him. Mr. Minch is survived by his widow, five children, and his parents.

Dan Douglas, 48, a quarryman in the employ of the Mississippi Lime & Material Co. at its Alton, Ill., quarry, was crushed to death recently by a falling bowlder. Together with other employees he was engaged in loading stone into trucks when the accident occurred.

Karl F. Snow, 70, one of the founders of the C. O. Bartlett & Snow Co., Cleveland, O., died recently after several weeks' illness. With C. O. Bartlett, his brother-in-law, he helped found this company 46 yr. ago. Mr. Snow had been active until shortly before his death in business and numerous civic projects. His survivors include the widow and two daughters.

Charles L. Jackson, 53, manager of the Flint Sand & Gravel Co., Amite, La., died on Jan. 27 while returning from a meeting of the board of directors at New Orleans. He was formerly manager of the Amite Sand & Gravel Co., Denham Springs, La.

Coming Events

March 6-10, 1933. New York, N. Y. Group meetings of the American Society for Testing Materials committees.

March 26-April 1, 1933. Washington, D. C. Eighty-fifth annual meeting, American Chemical Society.

June 25-30, 1933. Chicago, Ill. Sixth Midwest Engineering and Power Exposition. Chicago Coliseum. G. E. Pfisterer, director, 308 W. Washington St., Chicago, Ill.

June 26-30, 1933. Chicago, Ill. Annual meeting, American Society for Testing Materials, Stevens Hotel. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

Financial News

The information contained in these financial pages is given with the understanding that any statement on the part of this magazine or any of its staff, as to the responsibility or standing of any person, firm or corporation, or as to the value of any property or securities is a mere expression of opinion, given as a matter of service to the readers of PIT AND QUARRY, *for which no responsibility in any way is to attach to this magazine or to any of its staff.*

Penn.-Dixie Shipments One Third of Capacity

The report of the Pennsylvania-Dixie Cement Corp. and subsidiaries for the year ended Dec. 31, 1932 (certified by independent auditors), shows a profit of $106,176 before depreciation, depletion and interest, comparing with a profit of $662,636 in 1931. After provision for depreciation, depletion and interest, there was a net loss for the year 1932 of $1,866,231, against a net loss of $1,358,506 in preceding year.

The consolidated income account for year 1932, compares as follows:

	1932	1931	1930	1929
Net sales	$3,476,723	$6,117,674	$8,625,170	$9,610,646
Expenses (less other income)	3,370,547	5,455,038	5,884,560	7,113,689
Balance	$106,176	$662,636	$2,740,610	$2,496,657
Depreciation and depletion	1,382,402	1,393,129	1,379,289	1,395,916
Interest	590,005	628,013	669,376	706,175
Federal Taxes	.....	.....	104,484	62,298
Net loss	1,866,231	$1,358,506	†$587,461	†332,268
Preferred dividends	.....	.....	.....	711,574
Deficit	$1,866,231	$1,358,506	*$587,461	$379,306
Profit and Loss surplus	‡515,846	1,551,306	2,598,061	1,936,158

*Surplus. †Profit. ‡After crediting account with $267,148 profit on purchase of bonds of corporation under par, and $563,622 excess of par value over cost of preferred stock retired.

Current assets as of Dec. 31, last, including $2,910,286 cash, amounted to $5,024,960 and current liabilities were $320,297. On Dec. 31, 1931, cash and short-term securities amounted to $3,463,985, current assets were $5,902,582 and current liabilities $445,069.

The consolidated balance-sheet of the Pennsylvania-Dixie Cement Corp. and subsidiaries as of Dec. 31, 1932, follows:

Assets: Land buildings, machinery, equipment, etc., after depreciation and depletion, $21,958,113; cash, $2,910,286; notes and accounts receivable, $341,827; inventories, $1,772,847; investments, etc., $93,639; deferred charges, $22,129; total, $27,098,841.

Liabilities: 7-per cent. preferred stock $12,500,000; common stock, represented by 400,000 no-par-value shares, $4,000,000; gold bonds $9,655,000; accounts payable $78,962; accrued wages, interest, taxes, etc., $241,336; miscellaneous reserves $71,971; reserve for contingencies $35,726; surplus $515,846; total $27,098,841.

The current ratio of Pennsylvania-Dixie at the close of last December was better than 15 to 1.

Capital additions last year were nominal, amounting to $67,995, and were practically offset by the elimination of obsolete items. Bonds purchased in the open market during the year amounted to $468,000, increasing those held in the treasury, available for sinking-fund purposes, to $2,253,000. The profit on bonds purchased amounted to $267,148, which was credited to surplus, together with $563,622 arising from an excess of par value over the cost of 5,988 shares of the company's preferred stock bought in the open market and retired.

"Our bin cost of sales, during operations, was less than in 1931, notwithstanding a 37-per cent. reduction in production, and was lower than that of any previous year," Blaine S. Smith, president, stated. Production and shipments were less than one-third of the company's capacity.

"Including eliminations and adjustments, the salary pay-roll on Jan. 1, 1933, was 33 per cent. less than on April 1, 1931, and wage reductions averaged 31 per cent.," Mr. Smith said. "Total administrative and selling expenses was nearly a third less than the previous year's, and about one-half that of 1928.

"During the latter part of the year selling prices advanced, but most of the year's business was at the lowest levels in more than 15 yr. Our average price realized in 1932 was 9 c. a bbl. less than in 1931, and 70 c. less than in 1926.

"We continue to be harassed by foreign cement importations which increased during the year, particularly at the port of New York, notwithstanding the duty of 23 c. per bbl. This is due partly to the depreciated currencies of exporting countries."

Arundel Shows 1932 Net Profit of $720,316

The report of the Arundel Corp. (sand, gravel and contracting business), for the year ended Dec. 31, 1932 (certified by independent creditors), shows a net profit of $720,316 after depreciation, depletion, taxes, etc., equivalent to $1.46 a share on 492,556 no-par-value shares of capital stock. In 1931 the net profit, after depreciation, depletion, taxes, loss on abandonment and reconstruction of fixed assets, etc., was $2,012,479, equal to $4.08 a share.

The balance sheet, as of Dec. 31, 1932, shows total assets of $8,782,062, comparing with $9,740,083 at the end of 1931, and a profit-and-loss surplus of $2,834,650 against $3,544,719. Current assets amounted to $3,037,501 and current liabilities were $795,875 compared with $3,833,674 and $1,114,431 respectively, at the close of the preceding year.

At the annual stockholders' meeting of the company the retiring directors were reëlected.

U. S. Gypsum Plants Marked Down $7,700,000

The report of the United States Gypsum Co. and subsidiaries for the year ended Dec. 31, 1932 (certified by independent auditors), shows a net income of $1,599,416 after depreciation, depletion, federal taxes and after setting aside $150,000 as an extraordinary provision for bad debts. This is equal after 7 per cent. preferred dividends, to 86 c. a share (par $20) on 1,218,349 shares of common stock, and compares with a net income of $3,563,143, or $2.48 a share on 1,217,472 shares of common stock in 1931.

The declining trend in earnings from the preceding year which appeared in the first half of 1932, when the net was equal to 57 c. a share compared with $1.64 in the corresponding 1931 period, continued in the second half with a net indicated at 29 c. comparing with 86 c. a share in the second half of 1931.

The consolidated balance sheet, as of Dec. 31, showed a gain in net working capital, with current assets totaling $18,605,927 against current liabilities of $1,138,910 in comparison with $18,157,433 and $1,176,287, respectively, at the end of 1931. The cash increased to $1,556,623 from $923,034, and marketable securities, consisting almost entirely of United States government securities and the remainder municipal issues, advanced to $11,855,706 from $10,245,385. Receivables and inventories were reduced by approximately $1,000,000 each during the year.

The profit-and-loss surplus declined to $19,641,451 from $28,675,751, principally as the result of a reduction of $7,700,000 in the value of plants authorized by directors early in the year.

In his annual report to stockholders, Sewell L. Avery, president, stated: "Building activities continue at a low level. Production costs and overhead expenses have been subjected to con-

tinual reductions in an effort to meet conditions."

The building of new mills and the decline in business have reduced the value of some of the older plants. Based on the tonnage allotted to such plants, the board of directors at the May meeting authorized a reduction in the plant account of $7,700,000 to meet this condition. The balance sheet gives effect to this revision as of Jan. 1, 1932.

A comparison of the consolidated income account and balance sheet follows:

CONSOLIDATED INCOME ACCOUNT

Years ended December 31:

	1932	1931
Operating profit	$3,160,225	$ 5,789,927
Other income, net	437,101	373,517
Total income	3,597,326	6,163,444
Deprec. and deple	1,786,583	2,256,403
Federal taxes	61,327	343,899
Special provision for bad debts	150,000	.....
Net income	1,599,416	3,563,143
Previous surplus	28,675,751	28,235,563
Adjustment of Canadian exch.	21,509	*116,619
Total surplus	30,296,676	31,682,087
Reduction value plant	7,700,000	.....
Losses on plants, pat., inventories	503,845	551,451
Preferd. dividends	547,552	548,753
Com. dividends	1,903,828	1,906,131
P. & L. surplus	19,641,451	28,675,751

*Deduction.

CONSOLIDATED BALANCE SHEET

As of December 31:

Assets

	1932	1931
Current assets:		
Cash	$ 1,556,623	$ 923,034
*Mktble. sec. (cost)	11,855,706	10,245,385
Receivables	2,397,582	3,252,113
Inventories	2,796,016	3,736,901
Total current	$18,605,927	$18,157,433
Empl. stock purch. contr.	632,698	1,657,750
Bond res. deposits	223,745	180,592
Misc. secur.	119,522	86,246
Fixed assets	39,320,124	48,734,079
Defd. charges	994,354	1,071,296
Total assets	$59,896,369	$69,887,396

Liabilities

Current liabilities:		
Accts. pay.	$ 255,911	$ 577,492
Accr. liabs.	270,165	598,795
Divs. pay.	612,835	.....
Total current	$ 1,138,910	$ 1,176,287
Conting. res.	876,766	876,766
Other reserves	451,889	478,954
Pfd. stk.	7,822,200	7,822,200
†Common stk.	24,366,980	24,349,440
Paid in surplus	5,598,172	6,507,999
Earned surplus	19,641,451	28,675,751
Total liabs.	$59,896,369	$69,887,396

†Represented by 1,218,349 shares in 1932 and 1,217,472 shares in 1931.

*Market value, 1932—$11,880,760 and $9,634,461 in 1931.

Indiana Limestone Cuts Loss Almost in Halves

The Indiana Limestone Co. and subsidiaries in its report for the year ended Nov. 30, 1932, (certified by independent auditors), shows a net loss of $1,207,553 after depreciation, depletion, interest, etc., comparing with a net loss of $2,365,784 in the preceding fiscal year. The Indiana Limestone Co. was recently reorganized and in the future will be known as the Indiana Limestone Corp.

Current assets as of Nov. 30, 1932, amounted to $4,634,196 and current liabilities were $995,261, comparing with $4,418,131 and $1,681,436, respectively, on Nov. 30, 1931.

Consumers Assets Up and Liabilities Down

The Consumers Co. and subsidiaries in its report for the year ended Dec. 31, 1932, certified by independent auditors, shows a net loss of $931,892 after interest, depreciation, depletion, taxes, etc., and after providing $221,847 for the write-down of accounts receivable, comparing with a net loss of $442,700 in 1931.

Current assets as of Dec. 31, last, amounted to $5,897,504 and current liabilities were $2,779,764. This compares with current assets of $5,782,716 and current liabilities of $2,397,931 at the close of the preceding year.

International Salt Co. Stock Earns 37½ Cents

The International Salt Co. and subsidiaries in report for year ended Dec. 31, 1932, certified by independent auditors, shows net income of $514,684 after federal taxes, interest, depreciation, depletion, etc., equivalent to $2.14 a share on 240,000 no-par-value shares of capital stock. This compares with $748,770 or $3.12 a share in 1931.

Current assets as of Dec. 31, 1932, including $938,488 cash, amounted to $2,002,500 and current liabilities were $580,562. This compares with cash of $971,695, current assets of $2,129,171 and current liabilities of $848,237 on December 31, 1931.

The consolidated income account of The International Salt Co. and subsidiaries for the year 1932, compares as follows:

	1932	1931
Gross profit from sales, etc	$2,666,686	$3,055,997
Expenses	1,385,399	1,455,147
Depreciation and depletion	494,569	541,177
Federal taxes	74,461	97,214
Income from operations	$712,257	$962,459
Other income	64,096	52,537
Total income	$776,353	$1,014,996
Interest	261,654	266,198
Minority interests	15	28
Net income	$514,684	$748,770
Dividends	378,695	720,000
Surplus	$135,989	$28,770

The International Salt Co. declared the regular quarterly dividend of 37½ cents, payable April 1 to stock of record March 15.

Alpha Loss Mounts to New Heights in 1932

The report of the Alpha Portland Cement Co. for the year ended Dec. 31, 1932, shows a consolidated net loss of $1,763,616 after taxes, depreciation, minority interest, etc., comparing with net loss of $778,951 in 1931.

Current assets as of Dec. 31, 1932, including $5,767,593 cash, government and municipal securities amounted to $7,707,696 and current liabilities were $173,363. This compares with cash, government and municipal securities, of $6,027,328, current assets of $8,537,250 and current liabilities of $392,064 at end of preceding year.

The consolidated balance sheet, as of December 31, 1932, follows:

Assets: Land, buildings, machinery and equipment, after depreciation and depletion, $18,761,990; cash, $2,528,670; United States Liberty Loan and Treasury bonds, New York City corporate stock, municipal tax warrants, corporate bonds, etc. (at lower of cost or market), $3,238,924; working funds, advances, etc., $167,004; accounts and notes receivable, $447,200; inventories, $1,325,899; common capital stock of Alpha Portland Cement Co. (40,000 shares, at cost), $365,967; miscellaneous investments, at cost, $21,192; deferred items, $103,083; total, $26,959,929.

Liabilities: 7-per cent. preferred stock, $2,000,000; common stock (represented by 711,000 no-par-value shares), $18,486,000; accounts payable, $125,817; accrued taxes, $47,546; reserves, $621,649; minority interest in subsidiary company, $76,473; surplus (including $5,648,500 arising from reduction of stated value of common capital stock in 1931), $5,602,444; total, $26,959,929. Income account shows:

	1932	1931	1930	1929
Net sales	$3,857,756	$6,012,602	$9,936,820	$11,368,968
Expenses	4,313,218	5,645,344	7,366,812	8,336,699
Operating loss	$455,462	*$367,258	*$2,570,008	*$3,032,269
Other income (net)	85,084	223,990	185,842	307,297
Loss	$370,378	*$591,248	*$2,755,850	*$3,339,566
Depreciation	1,406,264	1,370,199	1,337,497	1,299,548
Federal taxes	.....	.....	170,000	225,000
Minimum interest	†13,026	.....	.....	.....
Net loss	$1,763,616	$778,951	*$1,248,353	*$1,815,018
Preferred dividends	140,000	140,000	140,000	140,000
Common dividends	171,475	711,000	1,599,750	2,133,000
Deficit	$2,075,091	$1,629,951	$491,397	$457,982

*Profit. †Credit.

Latest Portland-Cement Statistics

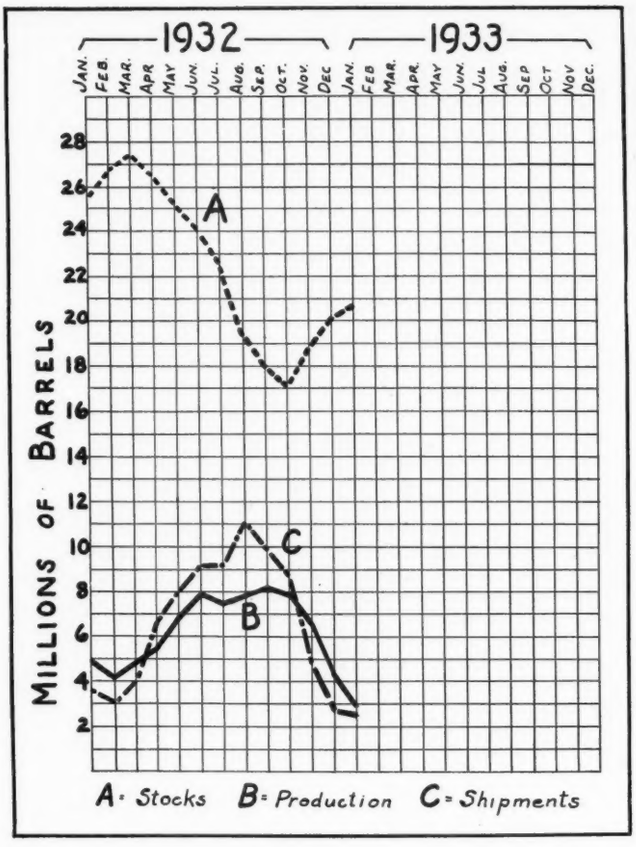


Chart showing monthly production, shipments and stocks on hand at end of month, from January, 1932, to December, 1933.

THE Portland-cement industry in January, 1933, produced 2,958,000 bbl., shipped 2,502,000 bbl. from the mills, and had in stock at the end of the month 20,660,000 bbl. Production of Portland cement in January, 1933, showed a decrease of 41.1 per cent. and shipments a decrease of 26.3 per cent., as compared with January, 1932. Portland-cement stocks at the mills were 19.9 per cent. lower than a year ago. The statistics here given are compiled from reports for January, received by the Bureau of Mines, from all manufacturing plants except three, for which estimates have been included in lieu of actual returns.

DISTRIBUTION OF CEMENT[1]

Shipped to—	November		December		January	
	1931	1932	1931	1932	1932	1933
Alabama	26,640	46,722	21,963	33,085	29,065	65,810
Alaska	1,634	8	25	5282	132	.....
Arizona	16,951	11,747	15,640	4,284	12,426	5,758
Arkansas	65,442	24,462	17,112	16,576	19,588	28,702
California	469,082	368,806	322,270	312,268	371,260	248,865
Colorado	38,269	30,044	22,047	12,797	13,598	10,805
Connecticut	115,392	55,588	51,564	29,343	37,618	26,209
Delaware	18,165	28,807	11,461	15,419	13,150	8,899
Dist. of Col	95,373	88,796	77,875	71,333	59,606	76,511
Florida	37,636	31,192	33,081	46,992	27,586	35,070
Georgia	127.940	96,639	83,222	64,203	100,950	92,250
Hawaii	21,443	14,050	12,473	12,400	16,983	12,946
Idaho	9,045	6,095	3,286	1,027	2,359	2,524
Illinois	405,403	272,348	193,244	99,279	103,901	71,367
Indiana	137,557	76,993	72,495	40,604	48,366	37,033
Iowa	75,128	86,539	34,916	30,487	22,943	22,080
Kansas	85,678	79,749	86,455	39,204	27,495	55,891
Kentucky	91,585	85,261	49,417	41,032	44,852	30,128
Louisiana	259,759	108,552	77,914	64,856	77,633	93,341
Maine	24,207	15,169	11,145	12,522	6,847	3,893
Maryland	198,274	101,789	133,256	75,581	87,662	35,046
Massachusetts	229,878	132,313	110,738	85,020	87,756	28,508
Michigan	191,085	94,471	119,925	36,172	92,394	38,780
Minnesota	90,893	35,044	35,166	24,515	31,018	7,518
Mississippi	15,502	42,922	5,820	29,850	14,040	27,356
Missouri	226,333	153,983	178,052	89,832	77,383	72,845
Montana	9,526	5,997	3,697	4,228	3,494	,6820
Nebraska	5,1644	49,924	25,655	12,092	6,897	10,799
Nevada	14,728	61,177	12,587	27,500	10,308	54,662
New Hampshire	30,201	26,044	9,272	4,655	7,667	4,512
New Jersey	397,146	178,586	212,095	119,347	165,341	92,250
New Mexico	11,907	12,752	9,934	7.803	6,292	10,604
New York	1,223,494	623,446	760,928	404,367	590,166	299,193
North Carolina	54,884	30,813	35,452	32,994	37,779	20,527
North Dakota	6,152	3,590	1,258	2,116	942	3,041
Ohio	371,566	248,100	194,959	144,416	161,775	82,682
Oklahoma	123,866	119,817	121,420	52,963	81,230	105,220
Oregon	52,625	19,121	16,332	12,151	26,097	17,283
Pennsylvania	526,424	376,978	298,610	239,051	251,407	156,684
Porto Rico	9,238	6,850	8,525	8,750	2,725	2,588
Rhode Island	35,655	19,367	26,601	13,145	22,151	5,636
South Carolina	165,616	10,783	52,483	15,994	33,652	7,520
South Dakota	14,179	6,325	8,749	4,133	3,721	7,068
Tennessee	128,207	111,559	44,322	59,147	36,629	38,976
Texas	368,199	363,185	223,504	168,989	255,469	286,316
Utah	12,860	20,118	6,861	5,729	6,730	3,281
Vermont	15,714	7,026	5,602	3,434	2,937	2,259
Virginia	116,823	57,857	78,200	55,574	64,365	34,550
Washington	71,142	45,327	50,654	20,126	45,904	18,587
West Virginia	83,257	43,485	50,176	49,690	45,752	32,661
Wisconsin	153,150	87,968	73,102	35,346	54,214	22,811
Wyoming	4,891	6,C11	2,661	3,219	1,261	3,008
Unspecified	.....	101,193	0	11,851	15,671	6,802
	7,127,388	4,732,008	4,114,201	2,807,573	3,367,187	2,473,844
Fgn. Countries	28,612	49,992	27,799	27,427	25,813	28,156
Total shipped from cement plants	7,156,000	4,782,000	4,142,000	2,835,000	3,393,000	2,502,000

[1] Includes estimated distribution of shipments of 3 plants in December, 1931 and December and January, 1932; from 4 plants in January, 1933.

RATIO OF PRODUCTION TO CAPACITY (*165 plants*)

	January		December	November	October
	1932	1933	1932	1932	1932
The month	22.0	12.9	18.5	29.1	34.6
The 12 months ended	45.9	27.6	28.3	29.0	29.6

PRODUCTION AND STOCKS OF CLINKER BY MONTHS, IN 1931 AND 1932 (*thousands of barrels*)

Month	Production		Stocks End of Month		Month	Production		Stocks End of Month	
	1932	1933	1932	1933		1932	1933	1932	1933
January	6,107	3,036	8,184	6,087	July	6,613	.....	7,889	.....
February	5,176	.....	9,375	.....	August	7,078	.....	7,175	.....
March	5,443	.....	10,025	.....	September	7,703	.....	6,708	.....
April	5,924	.....	10,511	.....	October	7,259	.....	6,093	.....
May	6,273	.....	9,922	.....	November	6,290	.....	5,938	.....
June	6,803	.....	8,877	.....	December	4,335	.....	5,996	.....

SUMMARY OF MONTHLY ESTIMATES OF PRODUCTION AND SHIPMENTS OF FINISHED PORTLAND CEMENT WITH ESTIMATED VALUE OF SHIPMENTS IN 1932, BY DISTRICTS (*thousands of barrels*)

Production	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1932	1931
E. Pa., N. J., & Md	1,511	1,315	1,509	1,497	1,334	1,389	1,162	1,508	1,606	1,457	1,002	805	16,095	28,640
New York & Maine	279	319	570	537	610	822	809	897	628	486	328	335	6,602	10,309
Ohio, W. Pa., & W. Va	246	215	241	309	471	645	582	650	792	1,053	757	638	6,599	11,564
Michigan	164	114	53	290	586	544	571	378	524	640	312	153	4,329	6,133
Wis., Ill., Ind., & Ky	540	515	688	564	821	1,128	1,144	1,211	1,255	1,242	988	477	10,573	15,174
Va., Tenn., Ala., Ga., Fla., & La	425	290	300	484	718	603	322	379	394	488	680	508	5,591	12,307
E. Mo., Ia., Minn., & S. D	534	358	325	420	822	1,103	1,143	985	1,039	927	894	422	8,972	12,968
W. Mo., Nebr., Kan., Okla., & Ark	567	179	251	83	476	563	789	645	698	634	546	220	5,651	9,182
Texas	338	280	304	397	208	335	278	325	427	218	351	289	3,750	6,189
Colo., Mont., Utah, Wyo., & Ida	39	7	39	93	105	157	111	206	222	185	107	0	1,271	2,216
California	336	316	521	535	538	464	584	513	514	443	424	320	5,508	7,740
Oregon & Wash	47	63	46	269	224	168	164	156	111	166	73	81	1,568	3,007
	5,026	3,971	4,847	5,478	6,913	7,921	7,659	7,835	8,210	7,939	6,462	4,248	76,509	125,429

Shipments	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	1932	1931	Plants shipping 1932	Estimated mill value of shipments, 1932
E. Pa., N. J., & Md	1,073	851	978	1,720	1,840	1,747	1,744	2,093	1,683	1,566	1,115	759	17,169	28,853	24	$16,650,000
New York & Maine	199	166	237	522	742	917	860	932	726	668	364	189	6,522	10,741	11	6,814,000
Ohio, W. Pa., & W. Va	260	284	269	520	642	785	790	1,062	978	829	417	308	7,144	11,549	19	6,502,000
Michigan	121	121	128	259	416	676	644	786	849	665	158	65	4,888	7,169	13	4,446,000
Wis., Ill., Ind., & Ky	238	249	256	611	1,032	1,419	1,666	2,018	1,706	1,375	503	179	11,252	15,938	11	7,968,000
Va., Tenn., Ala., Ga., Fla., & La	404	359	448	537	509	532	493	604	457	580	518	377	5,818	12,311	19	6,644,000
E. Mo., Ia., Minn., & S. D	142	150	243	591	1,023	1,320	1,439	1,530	1,524	1,306	379	201	9,848	12,272	11	8,586,000
W. Mo., Neb., Kan., Okla., & Ark	202	239	288	505	616	637	511	661	698	631	370	164	5,522	9,633	13	5,061,000
Texas	241	256	380	368	323	324	307	386	315	381	352	165	3,798	6,265	9	4,668,000
Colo., Mont., Utah, Wyo., & Idaho	33	38	64	126	123	128	99	141	194	144	87	44	1,221	2,060	9	1,862,000
California	413	343	547	554	510	590	510	549	434	473	455	353	5,731	7,496	11	8,266,000
Oregon & Wash	67	62	135	223	244	189	155	206	165	125	64	31	1,666	2,864	9	3,368,000
	3,393	3,118	3,973	6,536	8,020	9,264	9,218	10,968	9,729	8,743	4,782	2,835	80,579	127,151	159	80,835,000

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT, BY MONTHS, IN 1931 AND 1932 (*thousands of barrels*)

Month	Production		Shipments		Stocks at End of Month	
	1932	1933	1932	1933	1932	1933
January	5,026	2,958	3,393	2,502	25,778	20,660
February	3,971		3,118		26,657	
March	4,847		3,973		27,545	
April	5,478		6,536		26,496	
May	6,913		8,020		25,394	
June	7,921		9,264		24,043	
July	7,659		9,218		22,512	
August	7,835		10,968		19,398	
September	8,210		9,729		17,878	
October	7,939		8,743		17,084	
November	6,462		4,782		18,788	
December	4,248		2,835		20,200	
Totals	76,509		80,579			

PRODUCTION AND STOCKS OF CLINKER, BY DISTRICTS, in JANUARY, 1932 and 1933 (*thousands of barrels*)

District	Production		Stocks at end of Month	
	1932	1933	1932	1933
Eastern Pa., N. J., and Md	1,599	455	915	591
New York and Maine	467	271	596	391
Ohio, Western Pa., and W. Va	454	234	903	411
Michigan	253	130	731	802
Wis., Ill., Ind., and Ky	758	571	718	490
Va., Tenn., Ala., Ga., Fla., and La	512	305	790	446
Eastern Mo., Ia., Minn., and S. Dak	531	288	456	404
W. Mo., Neb., Kan., Okla., and Ark	693	220	669	433
Texas	284	209	295	179
Colo., Mont., Utah, Wyo., and Idaho	73	0	162	340
California	448	353	1,548	1,345
Oreg. and Wash	35	0	401	255
Totals	6,107	3,036	8,184	6,087

PRODUCTION, SHIPMENTS, AND STOCKS OF FINISHED PORTLAND CEMENT, BY DISTRICTS, IN JANUARY, 1932 AND 1933, AND STOCKS IN DECEMBER, 1932 (*thousands of barrels*)

District	January						Stocks at End of December
	Production		Shipments		Stocks at End of Month		
	1932	1933	1932	1933	1932	1933	1932
Eastern Pa., N. J., and Md	1,511	416	1,073	532	5,242	3,645	3,761
New York and Maine	279	217	199	122	1,423	1,529	1,434
Ohio, Western Pa., and W. Va	246	214	260	191	3,474	3,029	3,007
Michigan	164	105	121	64	2,099	1,532	1,491
Wis., Ill., Ind., and Ky	540	613	238	147	3,120	2,633	2,167
Va., Tenn., Ala., Ga., Fla., and La	425	340	404	414	1,817	1,496	1,571
Eastern Mo., Ia., Minn., and S. Dak	534	242	142	110	3,491	2,383	2,250
W. Mo., Neb., Kan., Okla., and Ark	567	217	202	245	2,003	1,738	1,766
Texas	338	255	241	285	823	646	677
Colo., Mont., Utah, Wyo., and Idaho	39	0	33	79	486	446	524
California	336	339	413	281	1,151	1,040	982
Oreg. and Wash	47	0	67	32	649	543	575
Totals	5,026	2,958	3,393	2,502	25,778	20,660	20,205

EXPORTS AND IMPORTS OF HYDRAULIC CEMENT, BY MONTHS, IN 1931 AND 1932

Month	Exports				Imports			
	1931		1932		1931		1932	
	Barrels	Value	Barrels	Value	Barrels	Value	Barrels	Value
January	41,199	$115,678	36,704	$82,984	95,609	$120,298	14,375	$16,648
February	25,703	88,989	12,889	39,350	21,984	25,391	83,707	69,197
March	54,599	144,579	39,105	81,856	70,378	80,360	19,173	17,215
April	40,478	116,564	30,123	69,451	53,333	58,576	59,392	40,999
May	48,028	140,953	31,634	71,048	19,325	20,568	9,223	7,358
June	43,597	107,610	33,134	72,084	32,079	42,955	19,962	14,715
July	29,344	97,837	18,972	54,814	14,332	15,582	31,519	24,904
August	39,517	106,643	25,110	48,961	8,895	11,739	76,407	55,710
September	27,570	81,399	35,270	63,018	33,574	33,520	68,220	49,754
October	24,531	68,524	28,756	52,922	39,642	42,380	59,769	40,380
November	33,200	97,796	57,811	98,187	27,940	22,235	11,692	7,414
December	21,887	54,028	25,073	67,530	40,147	34,314	9,057	6,739
Totals	429,653	$1,220,600	374,581	$802,205	457,238	$507,918	462,496	$351,033

Traffic News and Comment

Recent I.C.C. Decisions

Cement.—The Interstate Commerce Commission has found the rates on cement from Spocari, Ala., to destinations in Missouri, Oklahoma and Texas, in Scale III and IV territories, unreasonable to the extent that they exceeded the Scale III and Scale IV rates prescribed in Oklahoma Portland Cement Co. *v.* D. & R. G. W., 128 I. C. C. 63, computed on distances over the actual route of movement. Reparation has been awarded, and the complainant allowed to use combination rates which might apply over the route of movement if such combination rates are lower than rates made by use of the scales prescribed.—I. C. C. Docket No. 24,626. Lone Star Cement Co., Alabama *v.* A. T. & S. F. *et al.*

Crushed Stone, Sand, Gravel and Slag.—Another mileage scale has been written into the decisions of the commission and shippers of coarse aggregates in Ohio find themselves confronted with a frozen rate structure and that higher than the rates which have moved traffic in that state in the past. Following complaints filed by various shippers in western Pennsylvania attacking the intrastate rates in Ohio under Sec. 13, the carriers in Ohio, with the exception of the A. C. & Y., the Nickel Plate, and the Wheeling, on Dec. 28, 1931, filed a petition with the commission alleging violation of Sec. 13 in the rates prescribed by the Ohio Public Utilities Commission. The plants of complainants in western Pennsylvania are located within 10 mi. of the Ohio state line. Rates from these points are made by use of the West Penn Scale prescribed in 104 I. C. C. 717, which provides for a joint-line arbitrary of 20 c. This arbitrary was assessed on some joint hauls and other carriers waived it. Rates within Ohio were on no definite basis, mileage considered, but were check in with group adjustments applying to the principal consuming markets. Complainants asked for the West Penn Scale to be applied without the arbitrary on both single and joint-line hauls. The carriers asked for the West Penn Scale with the privilege of assessing or waiving the arbitrary as they might see fit. Ohio shippers were generally agreed that there was no violation of the section and objected to the Interstate Commerce Commission taking jurisdiction over these rates. All parties seemed to agree on the car-load minimum weight of 90 per cent. of the marked capacity of the car, and that the commission should not prescribe rates for distances of 40 mi. and less, in order to allow the carriers to make rates for these distances that would allow them to meet motor-truck competition. The carriers introduced figures to show the additional revenue that would have accrued on the shipments that moved had the same shipments moved on the basis of the West Penn Scale. Crushed-stone shippers having plants located in Northwestern Ohio favored a grouping of the origin points in making rates to the large cities. Evidence was introduced to show that there was competition at Cleveland and Toledo with local slag-producing plants and stone brought into those markets by lake boats. Much evidence was introduced to show that motor-truck competition was a big factor in marketing stone and other aggregates in Ohio. Shippers generally and the Nickel Plate Railroad were opposed to any arbitrary for joint-line hauls. Among the exhibits presented at the hearing was one showing various scales of rates applying on coarse aggregates, the scale commonly known in Ohio as P. S. M. 923 being one of them. This scale was adopted by the carriers to be used as a minimum scale in Ohio in 1926, but it became instead a maximum scale. The examiner used this scale in his proposed report as a basis for making rates and this scale was prescribed by the commission with certain limitations. The report was written by Chairman Farrell, the findings being divided into four divisions as follows:

We find:

1. That the rates assailed on crushed stone shipped in open-top cars, in car-loads, from Hillsville, Shaw Junction and Walford, Pa., and the rates assailed on slag so shipped from Midland and Sharpsville, Pa., and from Weirton, W. Va., to destinations in Ohio, other than Toledo and Cleveland, are and for the future will be unreasonable to the extent that they exceed or may exceed rates made by the use of PSM 923 distance scale appearing in the Appendix to this report; and that the assailed rates from the said origins to Toledo and Cleveland are and for the future will be unreasonable to the extent that they exceed or may exceed rates made by the use of a scale 10 c. per ton lower than the said PSM 923 scale: Provided, that reasonable groups of points of origin and destination may be made, but each group rate should be based on the average distance from and to points in the group.

2. That the circumstances and conditions affecting intrastate transportation of aggregates within Ohio and interstate transportation from the said points of origin in western Pennsylvania and West Virginia to points in Ohio are substantially similar.

3. That the intrastate rates in Ohio on crushed stone, gravel, sand and slag, which are lower than the rates from western Pennsylvania and West Virginia to points in Ohio herein found to be reasonable, result and will result in undue preference of and advantage to shippers of intrastate traffic within the state of Ohio in undue prejudice to shippers of interstate traffic from said points in western Pennsylvania and West Virginia to points in the State of Ohio and in unjust discrimination against interstate commerce.

4. That said undue preference and advantage, undue prejudice, and unjust discrimination can and should be removed by the establishment of car-load rates on crushed stone, gravel, sand and slag, for intrastate transportation in open-top cars between points in Ohio, which shall not be lower for corresponding distances than the car-load rates on crushed stone and slag, to the same destinations prescribed in paragraph numbered 1 of these findings; Provided, that this paragraph shall not apply to intrastate transportation over distances of 40 mi. and less.

In computing rates under the foregoing findings the distances to be used shall be those over the shortest routes via existing connections for the interchange of car-load traffic, embracing in each instance as a maximum the lines of not more than three line-haul carriers.

The establishment of rates provided in this report will remove any undue prejudice which may now exist between shippers in the interstate commerce involved in this proceeding.

Commissioner Aitchison, dissenting in part, objected to the commission taking jurisdiction over the entire state as the Pennsylvania and West Virginia shippers were not prejudiced over this wide territory. He also expressed the opinion that the increased rates would not result in increased revenues.

Commissioner Eastman, dissenting, objected to the level of the rates prescribed, the West Penn single-line scale being too high in his estimation, and the PSM 923 scale still higher, and they would result in undue prejudice to Ohio shippers. He also objected to the provision for grouping. PSM 923 scale provides the following rates: 45 mi., 80 c.; 55 mi., 85 c.; 65 mi., 90 c.; 75 mi., 95 c.; 90 mi., $1; 105 mi., $1.05; 125 mi., $1.15; 150 mi., $1.25; 175 mi., $1.35; 200 mi., $1.45. In the order the emergency charges authorized in Ex Parte 103 were authorized to be added to the scale rates.—I. C. C. Docket No. 25,020, Rates on crushed stone, gravel, sand and slag within the state of Ohio; No. 24,597, Bessemer Limestone & Cement Co. *v.* A. & B. B. *et al.;* Sub. No. 1, The Carbon Limestone Co. *v.* Same; Sub. No. 2, Lake Erie Limestone Co. *v.* Same; Sub. No. 3, The Standard Slag Co. *v.* Same; No. 4, Union Limestone Co. *v.* Same.

Lime.—In response to Fourth Section Application No. 14,880 the commission has authorized Southern carriers to establish and maintain rates on lime (common, hydrated, quick or slaked), from Security, Md., to points south of Ohio and Potomac Rivers and east of Mississippi River, the same as those contemporaneously maintained from Martinsburg, W. Va., subject to the limitations in the relief from Martinsburg, without observing the long and short-haul clause of the fourth section.—I. C. C. F. S. O. No. 9,639.

Poultry Grit.—In response to Fourth Section Application No. 14,810 the commission has authorized carriers to depart from the long- and short-haul clause of the fourth section in establishing rates, l. c. l., on poultry grit from Falling Spring, Va., to points in the south subject to the same circuity limitations that apply

on fertilizer, l. c. l., as prescribed in Fertilizers Between Southern Points, 113 I. C. C. 389, 123 I. C. C. 193 and 129 I. C. C. 215.

Examiners' Reports

Sand.—Examiner A. J. Sullivan proposes that the commission find the rates on silica sand in bags from Cincinnati, O., to Duluth, Minn., inapplicable, and that the applicable rate be found not unreasonable, but that the charges be found unreasonable to the extent that they exceeded those that would have accrued on a basis of a car-load minimum weight of 72,000 lb., and suggests that reparation be awarded.—I. C. C. Docket No. 25,161, Sanistone Products Co. *v.* Pennsylvania *et al.*

Examiner A. S. Worthington proposes that the commission find the rate on sand from Mapleton, Pa., to Irondale and New Salisbury, O., unreasonable to the extent it exceeded $2.40 per net ton and proposes that reparation be awarded.—I. C. C. Docket No. 25,498, McLean Fire Brick Co. *v.* Pennsylvania.

Talc.—Examiner P. F. Mackey proposes that the commission find the rates on talc from Hailesboro, Emeryville and Gouverneur, N. Y., to destinations in Official territory unreasonable to the extent that they exceeded or may exceed 20 per cent. of the contemporaneous first-class rate, provided that reasonable grouping might be allowed on rates for the future, and that the car-load minimum weight should be 60,000 lb. He proposes an award of reparation on this finding.—I. C. C. Dockets No. 24,848, International Pulp Co. *v.* N. Y. C. *et al.;* No. 25,307, Pittsburgh Plate Glass Co. *v.* Same; and No. 25,408, Stedman Rubber Flooring Co. *v.* Same.

New Complaints Filed

Basic Commodities.—The commission entered into an investigation of the rates on certain basic commodities at the request of petitioners, The American Farm Bureau Federation, Farmers' Educational & Coöperative Union of America, National Coal Assn., National Grange, Patrons of Husbandry, and the National Lumber Manufacturers' Assn. The petition requests the commission to recognize the existence of an emergency, and the importance of the freight-rate level in connection therewith, and to order rail carriers engaged in interstate and foreign commerce to appear in an *ex parte* proceeding and show cause why they should not be required immediately to cease and desist from charging the present unreasonable and inordinately-high freight rates upon basic commodities. The petition contains the following statements:

> The severe decline in the price level of basic commodities with substantially no decline in the freight-rate level has thrown the economic structure so seriously out of balance as to imperil the ability of the industries represented by your petitioners to supply traffic for the railroads. The situation to-day is similar to that which induced the commission to take action in the proceeding known as Reduced Rates, 1922, except that the disparity between the level of commodity prices and freight rates is now much greater. Experience has demonstrated that the action of the commission in decreeing an increase in the freight-rate level in 1931 did not produce the results sought. (Fifteen Per Cent. Case, 1931).
>
> A reduction in the freight-rate level on basic commodities will tend to discourage undue development of competitive transportation agencies and thereby preserve railroad transportation as the dominating factor in our national commerce. Under conditions which prevail to-day the value of railroad property and the rate of return on railroad investment must reconcile themselves to the ultimate effect of freight rates on traffic and revenues. Rail transportation is of basic and fundamental importance to our national prosperity. The railroad transportation machine is a necessary part of our economic structure and it can not be served and considered alone. It is entitled to be recognized as essential to distribution, but it is not entitled to preferential consideration, particularly if such consideration operates to cripple and hamper the industries which produce the traffic upon which the railroads live.
>
> The dollars which your petitioners pay to the railroads for transportation services are secured from the sale of commodities which move by rail. It requires approximately twice as much, in terms of commodities, to pay the rail-freight charges to-day as it required during the period from 1923 to 1930 when the freight-rate charges were substantially what they are to-day (except for the surcharges which have been added). Correspondingly the capital assets of your petitioners have depreciated in value and in the case of many basic industries are worth not more than one-third of what they were in the prior period. The decline in business has reduced the earning power of your petitioners and in turn depreciated the present value of their facilities and property.
>
> In like manner it must be evident that the property of the railroads used in the service of transportation has depreciated in value to the extent of the decline in the volume of tonnage transported. This destruction of values will continue as long as the policy of the railroads continues to be to maintain freight rates at a level which discourages the movement of traffic. For the railroads to assert, under prevailing economic conditions, that their properties are to-day worth more than $25,000,000,000 and for them to contend that present freight rates should be maintained in order to give them a return upon such valuation is to disregard fundamental changes which have taken place. To the extent that the freight-rate structure is adjusted in keeping with the adjustment of commodity-price levels it will encourage a greater movement of commodities and should be a basic factor in economic recovery.

The investigation is being carried on by the commission as an *ex parte* proceeding, being numbered 110. The carriers were given until Feb. 17 to answer the petition and argument is to be heard at Washington, D. C., on March 24. Letters are being received by the commission from various firms and organizations in support of the petition, but such letters are not considered as a part of the record and will not be used in writing the report.

Crushed Stone.—Reparation is sought on an allegation of violation of Sec. 1 and 3 on shipments of crushed stone from Sugar Creek, Mo., to points in Missouri via interstate routes in I. C. C. Docket No. 25,743, The State Highway Commission of Missouri, Jefferson City, Mo. *v.* A. T. & S. F. *et al.*

Lime.—New rates and reparation are sought in a complaint alleging rates and charges in violation of Sec. 1 and 3 on common or hydrated lime from Denie, Ala., to Akron, O., with competitors at Ste. Genevieve, Mo., preferred.—I. C. C. Docket No. 25,738, Muscle Shoals White Lime Co., Sheffield, Ala. *v.* A. & B. B. *et al.*

Sand and Gravel.—Complaining of unreasonable rates and charges on sand, gravel and related articles from Reader and Antoine, Ark., to Carroll and Atkins, La., complainant asks for new rates and reparation in I. C. C. Docket No. 25,715, Louisiana Highway Commission, Baton Rouge, La. *v.* L. & A. *et al.*

Rate-Committee Dockets

New England Freight Assn.

Crushed Stone.—To meet competition from local ledge carriers propose to reduce rates on crushed stone[1] from Branford (Pine Orchard Quarry), East Haven, East Wallingford (Reed's Gap Quarry), Meriden (York Hill Quarry), Mt. Carmel, New Britain (Cook's Quarry), Rocky Hill, Conn., and Westfield (Hampden Quarry), Mass., to Quinebaug, Conn. Representative of the adjustment proposed are the reductions from Branford (Pine Orchard Quarry), Conn., from $1.30 to 90 c. per ton and from Westfield, Mass., from $1.30 to $1.00 per ton.—Docket No. 28,172.

Slag.—An advance in the rate on basic slag or ground, slag car-load minimum weight 60,000 lb., from Boston to Lowell and South Wilmington, Mass., to the fertilizer basis of 8 c. is proposed by carriers.—Docket No. 28,265.

Trunk Line Assn.

Cement.—Shippers propose the establishment of a rate of 16 c. per 100 lb., on cement, car-load minimum weight 50,000 lb., from Glens Falls, N. Y., to Honesdale, Pa., and of 13½ c. from Howes Cave, N. Y., to Honesdale.—Docket No. 30,397.

Carriers propose to increase the rate on cement, car-load minimum weight 50,000 lb., from Martinsburg, W. Va., to Melvale and Mt. Washington, Md., from 10 c. to 12 c. per 100 lb., to place Martinsburg on the basis of 114 per cent. of 12,710 scale, which is the basis used from other points in the same general territory.—Docket No. 30,415.

An increase in the rate on cement from Oswego, N. Y., to McConnellsville, Blossville and Humaston, N. Y., from 9 c. to 9½ c. per 100 lb., is proposed by carriers.—Docket No. 30,481.

Crushed Stone.—Shippers propose the establishment of a rate on crushed stone[1] from White Haven, Pa., to Mauch Chunk, Pa., of 40 c. per ton to expire April 30, 1933, and effective May 1, 1933, a rate of 44 c. per ton to expire July 31, 1933. On and after Aug. 1, 1933 a rate of 70 c. per ton will apply.—Docket No. 30,444.

Dolomite.—Carriers propose to publish a rate on roasted dolomite, car-load minimum weight 60,000 lb., from Blue Belle, Pa., to High Bridge, N. J., of $2.27 per net ton.—Docket No. 30,319, Sup. 1.

Feldspar.—Carriers propose the establishment of a rate on ground

feldspar, car-load minimum weight 60,000 lb., from Brookneal, Va., to Hatboro, Pa., of $4.20 per net ton.—Docket No. 30,354.

Firestone.—The establishment of a rate on firestone (mica schist), car-load minimum weight 60,000 lb., from Miquon, Ardsley, Somerton, Glenside, Spring Mill, Wernersville and Lavelock, Pa., to Donora and Donora (Baird), Pa., of $3.60 per net ton is proposed by carriers.—Docket No. 30,272, Sup. 1.

Carriers propose to publish a rate on firestone from the above points to Aliquippa, Pa., of $3.60 per net ton in supplement 2 to the same docket.

Shippers propose a rate on mica schist, car-load minimum weight 30,000 lb., from Bedford and Goode, Va., to Chicago and Joliet, Ill., of 25½ c. and to Vandalia, Ill., of 30 c. per 100 lb.—Docket No. 30,414.

Lime.—Shippers propose the establishment of a rate on fluxing lime having no commercial value for chemical or building purposes, car-load minimum weight 36,000 lb., from York Stations, Pa., Frederick, Md., and Martinsburg, W. Va., to Verona, Pa., of 9½ c. per 100 lb.—Docket No. 30,345.

Sand.—Shippers propose the publication of rates on sand [1] from Newport, N. J., to Ottawa, Ont., of 26½ c., to Sherbrooke, Que., 24 c. and to Beauharnois, Que., 26 c. per 100 lb.—Docket No. 30,446.

Central Freight Assn.

Crushed Stone.—A reduction in the rates on crushed stone and related articles in open-top cars from Kokomo, Ind., is proposed by carriers. The proposed rates are: to Peru, Ind., 60 c.; to Denver, 65 c.; to Macy, 70 c.; to Rochester and Tiosta, 75 c.; and to Plymouth, Ind., 85 c. per net ton.—Docket No. 34,662.

Crushed Stone, Ground Limestone and Amiesite.—Carriers propose to publish rates to apply from Shaw Jct., Pa., on (1) ground limestone, car-load minimum weight 60,000 lb., (2) crushed stone coated with oil, tar or asphaltum [1] and on (3) crushed stone and screenings [1] to apply on shipments (1) to New York, Pennsylvania, Maryland and West Virginia points; (2) to New York, Ohio, Pennsylvania and West Virginia points; and (3) to Pennsylvania intrastate points, made on the basis of the following mileage scales: Scales 1, 2 and 3 applying on the commodities as numbered heretofore and to the territories bearing the corresponding numbers. Rates shown under column S apply on single-line hauls and under J apply on joint-line hauls.

Miles	Scale 1		Scale 2		Scale 3	
	S	J	S	J	S	J
5	60	80	73	88	60	80
10	65	85	73	88	60	80
15	70	90	73	88	60	80
20	75	95	73	88	60	80
25	80	100	83	98	70	90
30	85	105	83	98	70	90
40	90	110	83	98	70	90
50	100	120	93	108	80	100
60	105	125	93	108	80	100
70	115	130	103	118	90	110
80	120	135	103	118	90	110
90	130	145	113	128	100	120
100	135	150	113	128	100	120
120	145	155	123	137	110	130
125	155	165	123	137	110	130
140	155	165	133	146	120	140
150	165	170	133	146	120	140
160	165	170	143	155	130	150
175	175	175	143	155	130	150
180	175	175	153	164	140	160
200	185	185	153	164	140	160
225	195	195	161	171	...	...
250	205	205	168	177	...	...
275	215	215	...	...	...	...
300	225	225	...	...	...	...

Fluxing Stone.—Carriers propose to publish rates on furnace or foundry stone in open-top cars, from Shaw Jct., Pa., to consuming points in Ohio and Pennsylvania the same as now apply from Hillsville and Walford, Pa.—Docket No. 34,479.

Gypsum.—Carriers propose to publish a rate of 14½ c. per 100 lb., to apply on ground gypsum, car-load minimum weight 80,000 lb., to alternate with the present rates from Alabaster and National City, Mich., to Battle Creek, Grand Rapids, Kalamazoo, Niles, Vicksburg and Watervliet, Mich.—Docket No. 34,563.

Ground Limestone.—Shippers propose the amendment of Item 1670 of C. F. A. Tariff 130-U, publishing a rating of 60 per cent. of the sixth-class on ground or pulverized limestone, car-load minimum weight 60,000 lb., to points in C. F. A. and Trunk Line arbitrary territories, by adding LaSalle, Ill., as a point of origin.—Docket No. 34,722.

Lime.—Carriers propose to cancel the following proportional rates per 100 lb. on agricultural or fluxing lime to Cincinnati, O.; from Woodville group, Sandusky group, Carey group, 13 c.; from Marion group, 11½ c.; from Marble Cliff group, 11 c.; and from the Cold Springs group, 10 c.—Docket No. 34,557.

Carriers propose a reduction in the rate on lime, car-load minimum weight 30,000 lb., from Milltown, Ind., to Waterloo, Ill., from 1 c. to 15 c. per 100 lb.—Docket No. 34,692.

Roasted Dolomite.—A reduction in the rate on roasted or burned dolomite from Narlo, O., to St. Louis, Mo., from $3.40 to $2.64 per net ton is proposed by shippers.—Docket No. 34,516.

Sand and Gravel.—A reduction in the rate on sand and gravel from Dundee, O., to Philo, O., from $1.40 to 95 c. per net ton is proposed by shippers.—Docket No. 34,506.

Carriers propose the publication of a rate on sand and gravel from Massillon, O., to Alliance, O., of 50 c. per net ton to expire with March 31, 1933, unless sooner cancelled, changed or extended. The present rate is 70 c.—Docket No. 34,555.

Slag.—A reduction in the rate on slag from West Middlesex, Pa., to Albion and Cranesville, Pa., from 90 c. to 80 c. per net ton is proposed by carriers.—Docket No. 34,733.

Illinois Freight Assn.

Amiesite.—It is proposed to establish a rate on amiesite (crushed stone coated with oil, tar or asphaltum), from St. Louis, Mo., to Lawrenceville, Ill., of $1.88 per net ton.—Docket No. 7,106.

Western Trunk Line Committee

Cement.—Shippers propose the publication of a provision allowing shipments of cement from Utica, Ill., to be stopped at LaSalle, Ill., to complete loading and shipments of cement from LaSalle, Ill., to be stopped at Utica, Ill., to complete loading at a charge of $6.30 per car.—Docket No. 3,138-E.

Crushed Stone.—It is proposed to establish a proportional rate on crushed stone [1] from St. Louis, Mo., group to Cedar Rapids, Ia., group, of 12½ c. per 100 lb., to apply on traffic originating east of the Illinois-Indiana state line, also Carolina or Southeastern territory. The present rate is 13½ c.—Docket No. 2,692-D.

Dolomite.—Shippers propose a reduction in the rate on roasted dolomite, car-load minimum weight 60,000 lb., from Chicago, Ill., to Houghton and Coles Creek, Mich., from 39 c. to 18½ c. per 100 lb.—Docket No. 1,241-F.

Lime.—Shippers propose the establishment of commodity rates on lime, car-load minimum weight 30,000 lb., from Menominee, Mich., to stations in Iowa, Nebraska, Minnesota, North and South Dakota, to be made on the basis of 1 c. over the rates from Fond du Lac, Wis., to destinations in Iowa and on the basis of the Fond du Lac rates to other destinations listed on pp. 25 to 31 inclusive of C. & N. W. Tariff 16,141-D.—Docket No. 2,689-H.

Sand.—Shippers propose reductions in the rates on silica sand to Blackwell, Okla., from Wedron, and Ottawa, Ill., from $4.50 to $3.32 per net ton, and from Browntown, Wis., from $5.02 to $3.56 per net ton.—Docket No. 8,284.

Southern Freight Assn.

Crushed Stone.—A line of rates on crushed stone [1] from Glenita, Va., to destinations on the C. & O., between Elkhorn City, Va., and Ashland, Ky., has been proposed. A statement of these rates will be furnished on request.—Docket No. 279.

Lime.—In lieu of domestic rates it is proposed to establish a rate of $2.70 per net ton on unslaked lime, in water-tight barrels or on hydrated lime in sacks, car-load minimum weight 30,000 lb., from Burns, Sherwood and Summerville, Tenn., to New Orleans, La., for export.—Docket No. 122.

It is proposed to establish the following reduced rates on lime from Landmark and Graystone, Ala., to Wallace and Saltville, Va.; on a car-load minimum weight of 30,000 lb., a rate of $3.80 and on a car-load minimum weight of 50,000 lb., a rate of $3.04 a net ton.—Docket No. 287.

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[1] The car-load minimum weight will be 90 per cent. of the marked capacity of the car, except that when the car is loaded to its full cubical or visible capacity, the actual weight will apply.

Foreign Developments

Compares Screen Curves and Fineness Modulus

In a paper presented at the 55th general meeting of the Association of German Portland Cement Manufacturers last year and published in *Zement* for Dec. 1 and 8 (21:671-675, 687-691), Dr.-Ing. A. Hummel discusses and compares the methods that have been developed for evaluating the grading of concrete aggregates—ideal screening curves such as those of Fuller, limiting sieve curves, and the computation of the "fineness modulus."

The development of the limiting-curve idea, according to Dr. Hummel, has considerably simplified the investigation of aggregates, even though the former does not wholly meet the needs of practice. The fineness modulus is of more general applicability than the limiting screen curve. The answer to the question, "Limiting screen curve or fineness modulus?," should be "Limiting screen curve *and* fineness modulus." The former will be useful within certain limitations, as in the case of an aggregate with a consistently uniform curve. If changes in the grading are required, these can be computed practically with the aid of the fineness modulus.

Object to Test Method Used for Railway Ballast

In the test for railway ballast employed by the German State Railway a container of 20-cm. (8-in.) diameter and 5-liter capacity is filled with the stone to be tested, and is subjected to repeated impacts of a 50-kg. (110-lb.) ram falling from a height of 50 cm. (20 in.). After each fall the container is turned 60 deg.

Dr.-Ing. G. Gerth and Dr.-Ing. O. Voigt of the Freiberg Research Bureau for Stone Quarrying and Utilization, writing in *Steinindustrie* (Berlin, 28:6-7, Jan. 12, 1933), object to this test on the ground that it does not indicate fairly the properties required from a ballast. The test differs from practical conditions mainly in that the ram is of practically the same diameter as the container, so that the whole mass of stone bears the blow, rather than only a part of it, as in tamping, where there is some lateral "give," and the test does not measure the resilience which is one of the essential properties of a good ballast. The weight of the ram and the height of its fall are also too great for a fair test.

After ramming, the stone is screened and evaluated by multiplying the various fractions by arbitrary "evaluating factors." Unfortunately, the basis for setting these factors has not been published. However, the writers show that two stones with quite different grading (one with 86.2 per cent. plus 30 mm., none between 10 and 30 mm.) yield the same result in this method of computing the quality of the ballast.

Method for Determining Slag Content of Cement

It is a difficult problem in chemical analysis to determine the quantity of basic slag admixed with a Portland cement, since the cement and the slag possess such similar chemical properties, particularly in their solubility in acids. Some years ago F. Hart reported the use of an alcoholic solution of acetic acid for the determination of blast-furnace slag in Portland cement on the basis of the slag's lower solubility in alcohol solution. Hart first ascertained the residue after the action of the alcoholic acetic-acid solution on the mixture of Portland cement and slag and then calculated the slag content on the basis of the residue insoluble in acid. This calculation, however, required the knowledge of the amount of residue for a considerable number of mixtures with determined slag content, and has thus been impracticable as a general laboratory method.

P. N. Grigorieff and S. E. Chaikina, Moscow, thus review Hart's method in *Tonindustrie-Zeitung* (56:1206-1207, Dec. 5, 1932) in an article reporting their interesting discovery which may offer a practical method of quantitative analysis. In their investigations the Russians observed that the amount of the acid-insoluble residue obtained in following Hart's procedure coincides approximately with the slag content which is being sought. The accompanying table compares the slag content actually present with that indicated by this method, in the case of different slags and various proportions in relation to the cement.

Whether or not this empirical method will actually be serviceable cannot, of course, be settled until it has been checked by further trials; the results reported were all obtained from tests with a single cement and with slag from only two sources, and it will be noted that in one case the slag actually present is always higher than that calculated, while in the other the calculated contents are generally higher.

Source		Admixture			Chemical Analysis	
of Portland Cement	of Slag	Actual %	Found %	Variation %	of Cement	of Slag
Noworossisk	Makcjewka	9.60	10.26	+0.66	21–22	SiO_2 31–32
"	"	10.19	11.12	+0.93	8–9	R_2O_3 10–11
"	"	9.28	8.47	−0.81	65–66	CaO 49–50
"	Noworossiskll	12.35	11.59	−0.76		SiO_2 30–31
"	"	11.59	11.01	−0.58	"	R_2O_3 12–13
"	Noworossiskll	10.32	10.02	−0.30		CaO 50–51
"	"	10.57	9.97	−0.60		SiO_2 32–33
"	"	10.80	10.49	−0.31	"	R_2O_3 8–9
"	Makcjewka	15.02	15.92	+0.90		CaO 48–49
"	"	15.38	14.74	−0.64	"	see above
"	"	15.33	15.93	+0.60		

French Study Set and Hardening of Cement

When the penetration of a Vicat needle into pats of setting cement is represented at successive ages as in Fig. 1, in which the coördinates are the penetration and the time elapsed, the set is shown to take place rapidly between points *B* and *D*, then to decelerate gradually to point *E*, and

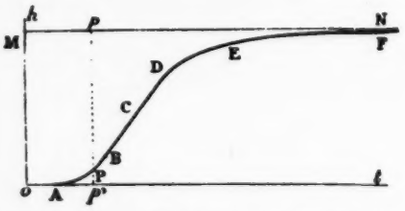


Fig. 1. Curve of cement set as a function of time.

from then on to decelerate rapidly. The curve *EF* is asymptotic to the horizontal *MN* representing the surface of the pat.

Edmond Marcotte, head of the physical and mechanical laboratory of the French Ecole des Ponts et Chaussees, writing in *Genie Civil* (Paris, 102:86-87, Jan. 28, 1933), considers that in differentiating the set of a cement from its hardening, the essential period of the set is represented by the curve *BCD*. In the investigation on which the article was based, the Vicat-needle studies were supplemented by studies of the adiabatic curve yielded by successive recordings of the heat liberated by the cement during its set. The apparatus for indicating the temperature is shown in Fig. 2. The cement paste, *P*, is placed in a metal container, *A*, fitted with a cover, *B*, for the entrance of the thermometer, *T*. The whole is placed in a wooden box, *C*, filled with sawdust.

Adiabatic curves of the setting process took the form of Fig. 3, representing the observed temperatures as a function of the time elapsed. There is a pronounced resemblance to the curve of Fig. 1. First appears a preparatory period $A'B'$, then a steep

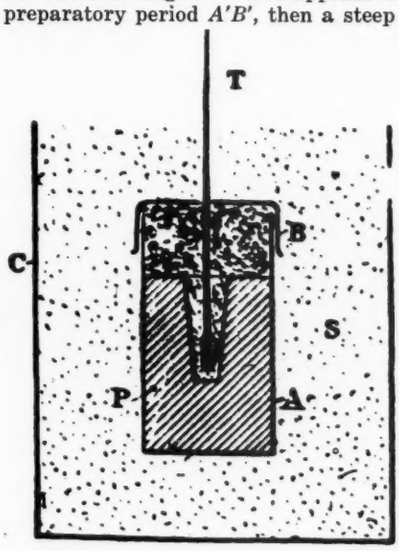


Fig. 2. Apparatus for measuring cement set by means of time.

incline $B'C'D'$ followed by a more gentle increase $D'E'$. The point E' represents the maximum of temperature. The decrease after E' is due to the escape of heat through the insulation; if this is corrected by measuring the cooling of water of the same temperature under the same conditions, the curve is the same as that obtained from the needle tests.

From the curves thus prepared M. Marcotte draws several important conclusions:

(a) That the adiabatic is trustworthy. Repeated tests with the same cement give the same results.

(b) The set is effectually begun at B', and $B'C'D'$ is the most important segment.

(c) The maximum E' is a measure of activity and of conservation. A cement "deadened" by storage will give an adiabatic of the same form as a fresh cement but will not reach the same maximum.

(d) Various types of cements yield differing adiabatic curves. With the supercements the increase is steeper and closer to the origin and the maxi-

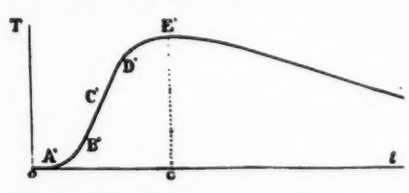


Fig. 3. Adiabatic curve of set, showing temperature as a function of time.

mum is higher. With fused alumina cement the increase and maximum are greater still. Slag cement gives a flattened curve. One of the possibilities of the test is that of revealing fraud or the presence of an admixture.

(e) The most surprising conclusion is that the area between the adiabatic curve and the time axis measures the future mechanical strength of the cement. The strength of the cement at 7 days, for example, is a function of the area limited to the right by a line drawn parallel to the temperature axis of abscissa $Ot = 7$ days. As the strength of the mortar or concrete of a given mix can be computed from the strength of the cement, and as the rate of increase in mortar and concrete strengths at successive ages is known for the more important cements, the thermal test has some importance in the prediction of strength.

The essential characteristic of the hardening process, as distinct from the set, M. Marcotte considers to be the rectilinear relation between strength and the logarithm of time. In the case of standard briquets and 5-cm. cubes of standard mortar tested in this study this relation did not exist until the age of 36 hr., distinguishing the hardening sharply from the setting.

Denmark Claims First European Rotary Kilns

In an article in *Tonindustrie-Zeitung* last year, abstracted in the November PIT AND QUARRY, it was said that the first rotary kiln in Europe was installed by Karl von Forell at Lollar, near Giessen, Germany. In the Jan. 16, 1933, *Tonindustrie-Zeitung* (57:53), F. L. Smidth & Co. of Copenhagen assert that the kiln at Lollar was a small laboratory kiln installed for experimental purposes, and that the first European plant to use rotary kilns was Smidth's plant at Aalborg, Denmark. Two rotary kilns taken from America were put in operation at Aalborg in the year 1898.

New Crushers and Kiln Go Into Austrian Plant

Although Austria, like other countries, has been hard hit by the depression, one of the Austrian cement producers is carrying out an ambitious program of plant modernization. This is the Gmundener Portlandzementfabrik Hans Hatschek at Gmunden, where new crushing departments have been built, both at the plant and at the quarry (at Ebensee), a new kiln and clinker-storage department has been constructed, and a new kiln and coal-preparation equipment installed.

The new kiln, according to a note in *Tonindustrie-Zeitung* (56:1182, Nov. 28, 1932), is a Lepol unit, chosen in preference to a waste-heat-kiln installation partly because the fuel economy saves an annual importation of between 1,000 and 1,200 car-loads of foreign coal and partly because it allows the plant to remain a customer for Austrian electric power. The clinker and coal-storage building is equipped with an overhead traveling clam-shell crane.

Growth of Pneumatic Conveying and Mixing

At the 55th general meeting of the Association of German Portland Cement Manufacturers last year Dr. Karl A. Goslich discussed in some detail the development of pneumatic conveying and mixing equipment for the cement industry, bringing together material not otherwise available except in many separate publications and catalogs. The paper is published, with some necessary omission of illustrations, in *Tonindustrie-Zeitung* for Jan. 2, 9 and 16, 1933 (57:5-6, 26-29, 50-52).

Pneumatic conveying, Dr. Goslich says, was developed for handling grain, F. E. Duckhan having made the first workable plant in London in 1893. It spread to the handling of mine refuse and of coal and ashes, and attracted the attention of the cement industry for the latter use. An early installation was made at the Deutsche Solvay-Werke plant at Bernburg for unloading coal from cars. The first installation for handling cement materials were used for conveying slurry. The first "Mammut" pump, in which air under pressure is blown into a vessel to lower the specific gravity and force the slurry up a conveyor pipe, was made in 1899 at the Hemmoor plant in Germany. Later slurry conveyors, such as those of Miag and Polysius, use pressure vessels and have a greater working range. The mixing of slurry by compressed air goes back to 1908, when such an installation was made at the Dyckerhoff plant at Biebrich, and improved machines for this purpose are now made by Polysius, Miag and Borsig.

The mixing of raw meal for the dry process had to wait for the satisfactory solution of the problem of conveying raw meal and similar fine powders. This in turn waited for the development of high-pressure apparatus, requiring a smaller quantity of air and lower velocities than the older machines using air under comparatively low pressure. A German patent of 1904 proposed a screw apparatus like the modern machines, but this patent seems never to have been utilized. The first satisfactory conveyor for meal was developed much later by Fuller-Kinyon. The Roco conveyor of Polysius is applicable also to coarse materials. The Polysius Cera pump is different in that it uses duplicate feeders, one of which is being filled while the other is in operation, thus avoiding some of the operating difficulties due to back pressure.

The Fuller-Kinyon pump also constituted the first practicable device for mixing raw meal. Cera pumps also are so used. More recently developed mixers are those of the Luxemburg cement works, in which air is introduced into a vessel through a great number of jets, and an apparatus of F. L. Smidth & Co. quite similar to it.

Recent Patents

AMERICAN

Cement and Concrete

Method of manufacturing concrete. Kaspar Winkler, Zurich, Switzerland. No. 1,891,701.

Apparatus and process for making cement. Chauncey B. Oliver, Oak Park, Ill., and Victor E. Vallet, Detroit, Mich., assignors to Oliver United Filters, Inc., San Francisco, Cal. No. 1,893,522.

Process of manufacturing Portland cement. James H. Colton, Berkeley, Cal., assignor to Pacific Portland Cement Co. No. 1,893,696.

Concrete delivery method. Harry J. Shaw, Toledo, O. No. 1,894,129.

Crushing and Grinding

Journal for pulverizing-mill rollers. Charles E. Needham, Chicago, Ill., assignor to Raymond Bros. Impact Pulverizer Co. No. 1,891,355.

Crushing or pulverizing machine. Edwin E. Elzemeyer and Henry Griesedieck, Webster Groves, Mo., assignors to American Pulverizer Co., St. Louis, Mo. No. 1,892,697.

Crushing-and-mixing machine. Otto J. Lehrack, Mission Township, Kan. No. 1,894,106.

Crushing machine. Edgar B. Symons, Hollywood, Cal., assignor to Nordberg Mfg. Co., Milwaukee, Wis. No. 1,894,601.

Drilling

Rock drill. William F. Dalzen, Grosse Pointe, Mich. No. 1,891,276.

Percussive drill. Louis W. Greve, Cleveland, O., assignor to Cleveland Rock Drill Co. No. 1,891,411.

Rock drill. Louis W. Greve, Cleveland, O., assignor to Cleveland Rock Drill Co. No. 1,894,398.

Excavating

Dipper-stick control for excavating machines. Charles L. George, Findlay, O., assignor to Buckeye Traction Ditcher Co. No. 1,891,351.

Shovel-type excavator. Charles L. George, assignor to Buckeye Traction Ditcher Co. No. 1,891,352.

Latch-operating device for power shovels. Robert C. Frye, Hilliards, O. No. 1,891,529.

Slack-line excavator. Joshua H. Street, Chattanooga, Tenn. No. 1,892,086.

Elevating power shovel. Charles M. Fuller and Arthur C. Denison, Visalia, Cal., assignors to Chas. M. Fuller Corp., Ltd., Stockton, Cal. No. 1,892,881.

Accelerator attachment for excavating machines. John F. Robb, Cleveland Heights, O., assignor to Koehring Co., Milwaukee, Wis. No. 1,893,564.

Miscellaneous

Mast distributing apparatus. James E. Bushnell, North Plainfield, N. J., assignor to Ransome Concrete Machinery Co. No. 1,891,899.

Conversion of pulverous material into noduliform state. Niels Nielsen, Copenhagen, Denmark, assignor to F. L. Smidth & Co., New York, N. Y. No. 1,892,074.

Drive mechanism for shaker conveyors. William W. Sloane, Chicago, Ill., assignor to Goodman Mfg. Co. No. 1,894,923.

FOREIGN

Blasting and Explosives

Explosive capsules for blasting detonators and the like. O. Matter. British 383,642.

Stabilization of blasting explosives. V. H. Williams and Imperial Chemical Industries, Ltd. British 383,630.

Delay-action blasting detonators and the like. L. Mellersh-Jackson (Hercules Powder Co.). British 383,650.

Processes for the manufacture of cast explosive charges having a basis of ammonium nitrate. Dynamit Akt.-Ges. vorm. A. Nobel & Co. British 384,966.

Cement

Means for improvement of cement and cement mortar. Chemische Fabrik Grunau Landshoff & Meyer Akt.-Ges. French 725,024.

Improvements to alumina cements. J. C. Seailles. French 725,775.

Improvements in cements and in materials made from cements. Societe d'Applications des Pates de Ciment. French 726,323.

Process for preparing a raw mix for hydraulic or Portland cement. International Precipitation Co. French 728,290.

Improvements in mixtures of plaster and cement. Imperial Chemical Industries, Ltd. French 730,358.

Process for thickening sludges, especially cement raw slurry. Fried. Krupp Grusonwerk Akt.-Ges., Magdeburg-Buckau. German 555,895, addition to 530,640.

Process for producing cement mixes for plastering and surfacing. Cement Marketing Co., Ltd., Horace Keeble and Harry Norman Wrigley, London, England. German 553,360.

Process for producing a hydraulic binder and oil from bituminous chalk. Arnold Tetens, Finkenherd bei Frankfurt a. O., Germany. German 552,975.

Cementitious material of the high-alumina type. N. V. S. Knibbs. British 385,032.

Production of hydraulic cement. Gerald O. Case (Sevenoaks, Kent), Edith M. Ellis and Laurence H. Montique, London, England. Canadian 328,934.

Concrete and Concrete Products

Apparatus for producing tubes from cement, concrete or the like by spinning. Sugajiro Kuroyanagi, Sapporo, Japan. German 554,844.

Form for producing dense concrete tubes by spinning. Heinrich Nolze, Kaiserslautern, Rheinpfalz. German 555,048.

Process for making concretes of high electrical insulating power. E. P. C. Lambert. French 727,052.

New method for the gradual compression of the walls of pipe, etc., of concrete and the like. Soc. Anon. G. Vianini & Co. French 727,582.

Surfacing material of lime, a hydraulic binder and asbestos filler. Ernst Gustav Berendt, Bremen. German 555,894.

Process for production of a floor-surfacing material by mixing impregnated sawdust and cement. Friedrich Winzer, Hamburg. German 555,394.

Molding of blocks, slabs or like articles from cement or concrete or the like. H. Herzbruch. British 382,473.

Apparatus for conditioning ready-mixed concrete. E. A. Hoffmann. British 382,594.

Floors, roofs, walls and the like of cement, concrete and the like, and method of manufacture thereof. J. H. de W. Waller. British 382,610.

Methods for the manufacture of pastes, mortars, concrete, and other materials having a cement base. Soc. d'Applications des Pates de Ciment. British 383,475.

Crushing and Grinding

Safety device for gyratory crusher. Humboldt-Deutzmotoren Akt.-Ges., Köln-Deutz, Germany. German 553,750.

Ball crusher. Babcock & Wilcox, Ltd., London, England. German 553,752.

Hammer mill with recesses in the peripheral wall. Wilhelm Mast, Herne, Westphalia. German 553,706.

Hammer mill. Zeitzer Eisengiesserei und Maschinenbau Akt.-Ges., Zeitz, Germany. German 553,751.

Centrifugal grinding mill. Paul Griese, Leipzig. German 553,055.

Lugged roller mill. Josef Otto, Köln-Lindenthal, Germany. German 554,381.

Hammer for hammer crusher. "Miag" Mühlenbau und Industrie Akt.-Ges., Brunswick, Germany. German 554,677.

Apparatus for fine grinding of cement or the like in tube mills, using fine steel grinding elements. Otto Büttner, Altona-Rissen. German 548,853.

PIT AND QUARRY *will furnish, at its actual cost, a copy of any patent cited here. A charge of ten cents per copy is made by the U. S. Patent Office, Washington, D. C., and readers may procure a copy directly by addressing the Commissioner of Patents, with payment for copies requested. Postage stamps are not accepted by the Patent Office. We will endeavor to obtain copies of foreign patents for our readers but we cannot give assurance in every case for the reason that copies of such patents are not printed for distribution as liberally as are the American copies, nor is there a fixed charge per copy.*

Manufacturers' Publications

Copies of any of these publications may be had by writing the manufacturers who publish them. Please mention PIT & QUARRY *when writing.*

Air Valves

Automatic Control Valve. (Folder. Yarnall-Waring Co., Chestnut Hill, Philadelphia, Pa.) Describes automatic air-control valve designed to be used on air-lines to pneumatic tools. When the air pressure in the line decreases to a point where the tools can not be operated satisfactorily the valve automatically closes.

Machine-Shop Equipment

Lathes. (72 p. Cat. No. 93. South Bend Lathe Works, South Bend, Ind.) Illustrates, describes and prices the entire line of South Bend lathes and attachments in sizes from 8-in. to 24-in. swing.

Mechanical Rubber Goods

Diamond Brand. (24 p. Buyers' Guide. Diamond Rubber Co., Inc., Akron, O.) Describes and illustrates rubber drive, elevator, and conveyor belting, air, water, steam, vacuum and other types of hose and couplings, tubing, sheet packing, chute lining, gaskets and other kinds of mechanical rubber goods. Also gives many valuable facts about these materials, directions for ordering recommendations, etc.

Miscellaneous Equipment

Austin-Western Equipment. (24 p. Bull. 1272 Austin-Western Road Machinery Co., Chicago, Ill.) Describes and illustrates all kinds of road machinery and allied equipment made or handled by this company. This includes Austin-Western dump wagons, crushing and washing plants, Austin Badger convertible shovel, crane, dragline, and Cletrac crawler tractors.

"Monco" Crushers and Allied Equipment. (8 p. Monarch Manufacturing Co., Inc., Wilmington, Del.) Describes and illustrates "Monco" roller-bearing rock crushers, belt-conveyors, bucket-elevators, revolving screens, sand washers, and apron- and belt-feeders.

Screens

Universal Vibrating Screens. (Folder. Universal Vibrating Screen Co., Racine, Wis.) Describes the new 36-in. by 58-in. vibrating screen designed especially for service on portable conveyors, loaders, or at points of discharge from bins.

Shovels

Austin Badger Convertible Shovels. (28 p. Bull. No. 1271. Austin Mfg. Co., Chicago, Ill.) Gives a detailed description of the Austin Badger convertible shovel and shows it in use for various kinds of work. Also describes the wheel-mounts on which the shovel can be mounted or demounted in a few minutes' time.

Water Pumps

Deep-well Turbine Pumps. (32 p. Bull. No. 336. Byron Jackson Co., Berkeley, Cal.) Describes and illustrates all types and sizes of deep-well turbine pumps, showing their construction and giving sizes and capacities. Many recent installations are also described.

Operation at full capacity was resumed early in February at the Siegfried, Pa., plant of the Lawrence Portland Cement Co. About 150 men were called back to work. The plant had been closed since Nov. 16.

Rock-Fill Dam Contract Awarded at $8,600,527

Supervisors of Los Angeles County, Cal., have awarded a contract for the erection of a rock-fill dam in San Gabriel Canyon to the West Slope Construction Co. The cost of the improvement will be $8,600,527. The West Slope company has established offices at 810 South Spring St., Los Angeles, the firms which combined to form it and win the award being Bates & Rogers Construction Co., Chicago; Foley Bros., Inc., St. Paul, Minn.; and Lawler & Maguire, Inc., Butte, Mont.

Pumpings from the Old Pit

Fifteen Years Ago

DELEGATES from Illinois, Iowa, Indiana, Missouri, Michigan, Alabama, Wisconsin and Ohio met on January 16, 1918, at the Chittenden Hotel, Columbus, O., and formed the National Crushed Stone Assn. Complete details of organization were not discussed as the meeting was hastily arranged in order that the association could be represented on the board of directors of the Highway Industries Assn., which held its annual meeting a few days later. Temporary officers and committees were elected to serve until the scheduled organization meeting set for Feb. 7 and 8 at the LaSalle Hotel in Chicago.

Ten Years Ago

THE seventh annual convention of the National Sand & Gravel Assn. was held at the Raleigh Hotel, Washington, D. C., on Jan. 24 to 26, 1923. Among the subjects discussed was methods to be used in combating the use of wayside-pit material. The principal speaker at this convention was Herbert C. Hoover, then Secretary of Commerce, who reviewed the progress of industry since the war and told of some of the things in store for it in the near future. After his talk Mr. Hoover offered to answer questions on any matters falling within his jurisdiction. Many of those present took advantage of this opportunity, most of the questions having to do with the railroad transportation situation. Mr. Hoover answered all questions briefly, clearly and, as subsequent developments proved, correctly.

Five Years Ago

L. G. EVERIST, INC., began the construction of a new modern, all-steel sand-and-gravel plant at Hawarden, Ia.

* * *

Scott Thompson took up the duties of vice president of the Louisiana Portland Cement Co., New Orleans, La., a subsidiary of the International Cement Corp. Lewis R. Ferguson, former vice-president, was appointed assistant to the president of the parent company.

* * *

D. A. Cheyette entered the employ of the Traylor Engineering & Manufacturing Co. as assistant to R. R. Shafter, manager of the New York district.

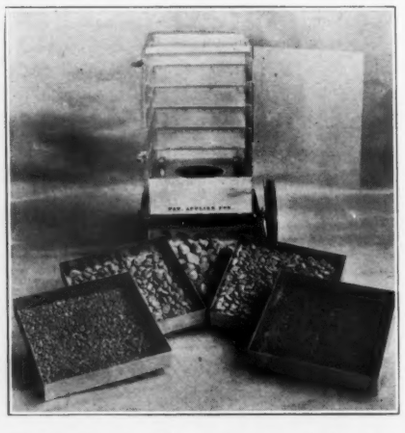
New Machinery and Supplies

New Detachable Drill Bit Made in All Sizes

The Crucible Steel Co. of America, 405 Lexington Ave., New York, N. Y., has developed a Crusca detachable bit to be used with Crusca hollow drill shanks. The drill bit is made in one piece of high-quality steel. These bits are triple-threaded and are made in three groups to fit the shank steel. Type A fits on 1-in. hollow round steel with ⅞-in. hexagon by 3½-in. long shanks and is made in gauges of from 1½ to 2 in. Type B fits on 1⅛-in. hollow round steel with 1-in. hexagon by 4½-in. long shanks and is made in gauges of from 1⅝-in. to 2¼-in. Type C fits on 1¼-in. hollow round steel with standard lugged shanks and is made in gauges of from 1⅞-in. to 2¾-in.

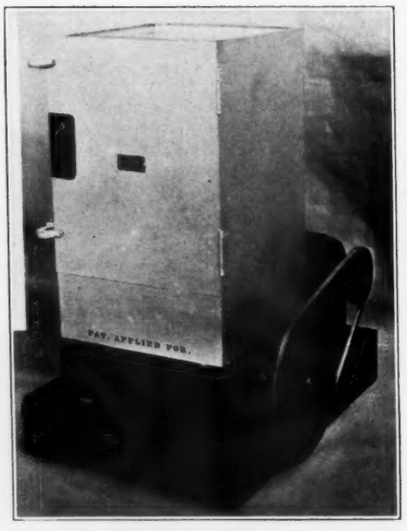
Coarse Aggregate Tester Designed for Producers

The Hendrick Mfg. Co., Carbondale, Pa., has developed a new testing screen for coarse aggregate which was designed to meet a demand for testing at plants of producing companies, where testing must be quickly and thoroughly done, and where the testing sieves must be readily accessible at any time.



Testing screen with pans removed to show well-graded sizes.

The sieves in this machine are 18-in. square and will take a 50-lb. sample of stone and screen it thoroughly in from 1½ to 2 min. The screen box is held in position by four bolts, one on each corner. These bolts hold the box down on rubber shock absorbers by the compressive action of springs attached to the lower ends of the bolts. A shaft mounted centrally beneath the box has two cams with high points set 180 deg. from each other. As the shaft rotates the cams act against followers fixed in the bottom of the screen box,



Testing screen closed up ready to operate. Note compactness.

raising each side of the box alternately and dropping the box ½ in. from the high point of the cam on the shock absorbers. The bolts holding the box in place have enough clearance so that, as the box is raised up and down, there is also a slight motion back and forth in a horizontal plane.

New Three-Way Crawler Dump Wagons Announced

The Trackson Co., Milwaukee, Wis., has added 3-way crawler dump wagons of 7 to 10½-cu.yd. capacity to its line of dirt hauling wagons. At the present time the company manufactures two sizes of bottom-dump wagons, one size of 3-way dump wagon and two sizes of crawler wheels.

The body of the new wagon is fabricated from ¼-in. high-carbon steel plate and is especially designed for rock loading. The tops of all gates are double flanged, then reinforced to ½-in. thickness all around. As additional protection from the battering blows of loading equipment, the side gates are topped with wood buffers encased in steel. The body floor is of the sandwich type, i.e., finished hard oak between top and bottom plates in order to cushion the buffeting of falling rock.

An improved dumping mechanism is said to assure smooth, positive and dependable operation even over rough and yielding dirt fills. The hoist and dump are oversized for fast operation. The chassis is fabricated from steel plate electrically welded together into a box section, making an integral nonweaving unit. A hydraulically-operated front-end jack is provided as standard equipment.

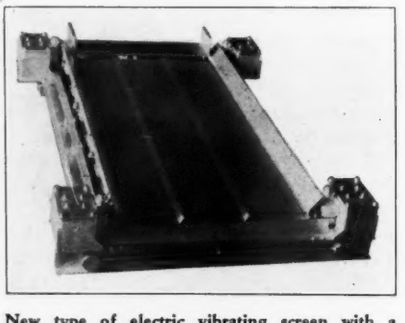
Reveals Details of a New Vibrating Screen

A new vibrating screen—the Type 400—has just been placed on the market by the W. S. Tyler Co., Cleveland, O., coincident with the first public exhibition of the new machine at the Highway and Building Congress held at Detroit in January.

The Type 400 Vibrator, an electrically-vibrated screen, is a radical departure from the Hum-mer screen Machinery—Copy 119-141 ... . manufactured by the company for many years. It provides 1,800 short, powerful strokes per minute combined with a sharp impact. This type of vibration allows the material to hug the screen cloth, each particle twisting and turning, the fines working down to the screen cloth and through the openings. Each of these 1,800 vibrations is terminated with a sharp impact so necessary to prevent blinding the screen openings.

There are four electric vibrators—one at each corner. The two vibrators at the upper or feed end are yoked together by a cross-armature beam. The vibrators at the lower or discharge end are yoked together in the same manner. These armature beams are intensely vibrated and transmit this vibration to the screen-cloth stretching and supporting structure.

The supporting and stretching structure of the Type 400 screen provides a rigid, taut screening surface. The rubber-covered supporting bars will carry any load that is given the screen and hook bolts keep the screen surface in constant tension.



New type of electric vibrating screen with a vibrator at each corner.

The wire cloth is not subject to a racking or bending motion but is kept smooth and taut until worn out by abrasion of material passing over the screen. If wear is unusually heavy on the upper end of the screen, the cloth can be applied in two sections.

The W. S. Tyler Co. announces that it will continue to manufacture its full line of Hum-mer electric screens, in addition to the new Model 400 screen.

Cement-Clinker Cooler Operates by Vibration

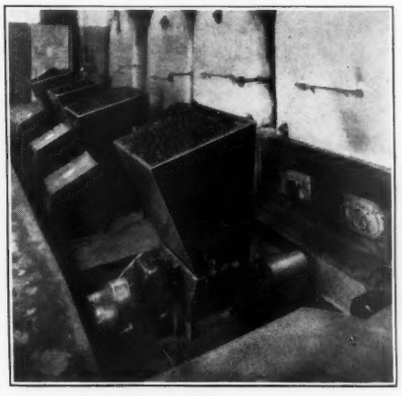
The Traylor Vibrator Co., Denver, Colo., has developed a new vibrating cooler for cement clinker. This new unit is another indication of the trend toward the use of coolers in which the clinker is cooled by blowing air at low pressure through the clinker bed as it travels over a deck. In this particular type the cooler has no bearings, shafts, or other moving parts which require lubrication and are therefore not well suited to high-temperature cooling problems.

The inside width of the Traylor vibrating cooler is 31-in. and it is 40-ft. long. Four heavy-type vibrating units are applied to the cooler conveyor underneath the cooling surface. The plates forming the conveying surface are made of special steel to stand up under high temperature and are also arranged to give the proper intake and direction of air as it is required to give the proper amount of cooling. The use of overlapping plates on the deck gives a tumbling action to the clinker for efficient aeration and, it is said, the large openings between these plates allow the use of low air pressure and keeps them from blinding without any leakage of clinker through the plates.

The vibrating units give 3,600 impulses per minute to the deck and the intensity of these impulses may be varied quickly by merely turning a rheostat so that the travel of the clinker may be regulated from zero to about 40 ft. per min. The conveyor is applied to an I-beam and is supported at regular intervals by means of steel bars acting as cantilevers between the I-beam and the bottom of the conveyor. The air inlet is at the bottom and outlet points can be arranged to suit the conditions governing each particular problem. These coolers may be operated from almost any standard frequency or voltage of alternating-current power.

Automatic Underfeed Stoker is Announced

The Link-Belt Co., 2410 W. 18th St., Chicago, Ill., one of the pioneer manufacturers of coal and ash-handling machinery, recently announced the new



Automatic underfeed stoker for boilers up to 250 b.h.p.

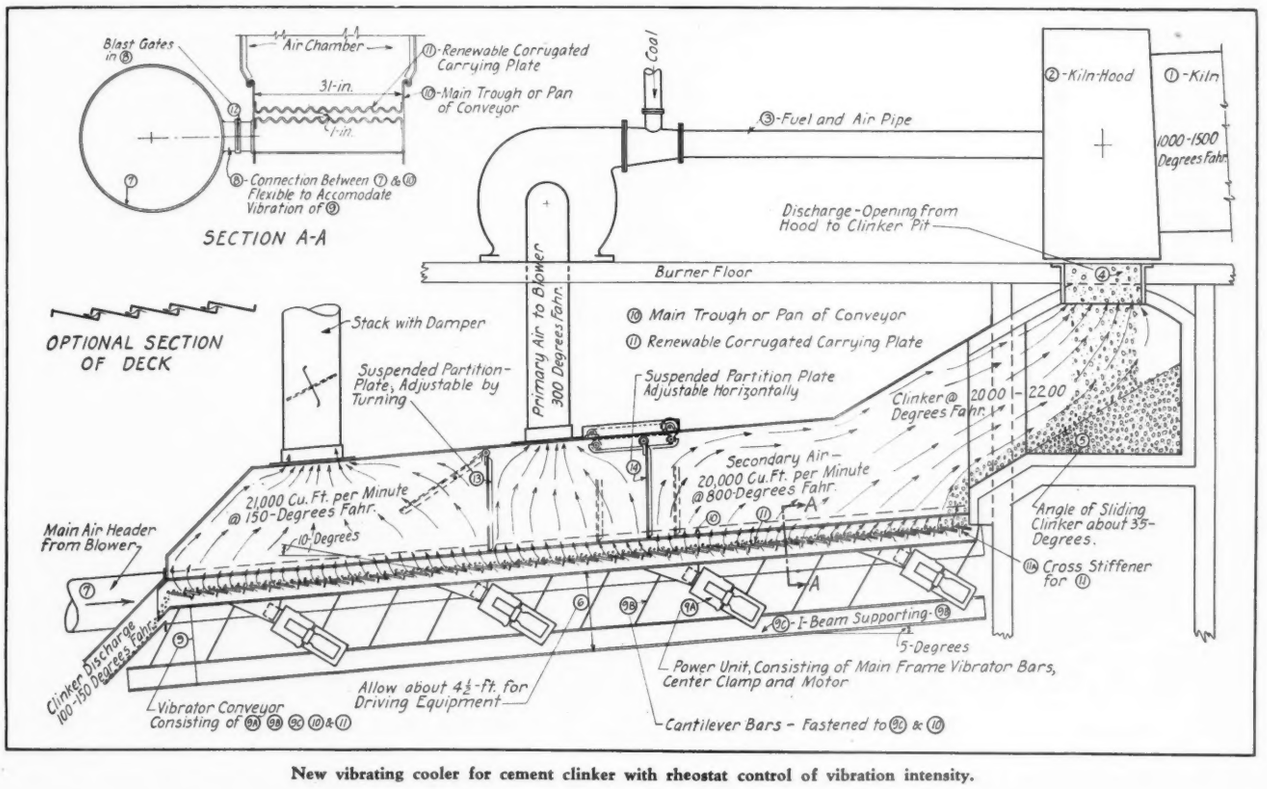
Link-Belt automatic underfeed screw stoker. This is at present being made in a number of sizes from 10 to 250 b.h.p. A unique design of motor mounting permits direct connection to the forced-draft fan and provides an easily-accessible and compact assembly. It also has automatic electric controls for operating at predetermined boiler pressures. The screw conveyor is of chrome steel and the finished castings of heavy grey iron.

New Device Measures Magnetic Impurities

Magnetic impurities in asbestos, mica, glass, sands, and other similar materials are easily detected and their extent measured by means of a new magnetic device announced by the General Electric Co. The equipment was first developed for use in the General Electric shops for determining the amount of magnetic oxide of iron present in asbestos, but it is expected to have wider application in industry.

In its application to analyzing asbestos the device tests specimens containing up to 5 per cent. of magnetic ferric-oxide impurities; operates on 110-v., 60-cycle circuits; and can be used by workmen unskilled in electrical measurements.

The device consists of a differential permeameter and an indicating device. In the case of asbestos, the magnetic effect of the iron impurities is proportional to the quantity of impurities present. The permeameter consists essentially of a coil for producing a high magnetic field for magnetizing the specimen, and two equal secondary coils for measuring the magnetic effect. These latter coils are placed in the magnetizing coil and connected to the indicator with their induced voltage in opposition. The specimen is placed in one of the secondary coils, thus disturbing their electrical equality. The effect on the indicator is proportional to the quantity of magnetic impurities present.


Blast Gates in ⑧
Air Chamber
31-in.
7-in.
⑪-Renewable Corrugated Carrying Plate
⑯-Main Trough or Pan of Conveyor
⑫-Connection Between ⑦ & ⑯ Flexible to Accomodate Vibration of ⑨
SECTION A-A
Coal
③-Fuel and Air Pipe
②-Kiln-Hood
①-Kiln
1000-1500 Degrees Fahr.
Discharge-Opening from Hood to Clinker Pit
Burner Floor
Primary Air to Blower 300 Degrees Fahr.
⑯ Main Trough or Pan of Conveyor
⑪ Renewable Corrugated Carrying Plate
Stack with Damper
OPTIONAL SECTION OF DECK
Suspended Partition-Plate, Adjustable by Turning
Suspended Partition Plate Adjustable Horizontally
Clinker @ 2000 - 2200 Degrees Fahr.
Secondary Air — 20,000 Cu. Ft. per Minute @ 800-Degrees Fahr.
21,000 Cu. Ft. per Minute @ 150-Degrees Fahr.
10-Degrees
Main Air Header from Blower
Angle of Sliding Clinker about 35-Degrees.
⑯a Cross Stiffener for ⑪
⑨c-I-Beam Supporting-⑨
5-Degrees
Clinker Discharge 100-150 Degrees Fahr.
Power Unit, Consisting of Main Frame Vibrator Bars, Center Clamp and Motor
Allow about 4½-Ft. for Driving Equipment
Vibrator Conveyor Consisting of ⑨A ⑨B ⑨C ⑩ & ⑪
Cantilever Bars - Fastened to ⑨C & ⑩

New vibrating cooler for cement clinker with rheostat control of vibration intensity.

Saving Through Safety

Eye Accidents Still Big Cement-Mill Loss

By W. L. WHITE, JR.
General Supt. and Chief Engineer, Medusa Portland Cement Co. and Chairman, Cement Section National Safety Council

BLINDNESS is one of the greatest human catastrophies. Impairment of vision is one of the most serious of physical handicaps. Both are needlessly inflicted on many workers every year and unfortunately some of these misfortunes have occurred in the cement industry.

Among the cement plants, I am happy to say, we have never taken the loss of an eye coolly enough to evaluate it at the commonly-used figure of $1,800 or the entire loss of sight at $3,500. These figures may reflect accurately the compensation paid but they allow nothing to the employer for the loss or impairment of an expert worker or for the cost to the public of training and rehabilitating a blind man. Worst of all, they can not pay the victim for a shattered future or the community for reduced earning capacity and the possible dependency involved.

Eye injuries have always been among the more numerous types of cement-mill and quarry accidents and the seriousness of even slight injuries of this kind has justified giving special attention to them. The results accomplished during the last five years have been gratifying, for the number of eye injuries in the member plants of the Portland Cement Assn. has dropped from a total of 234 in 1926 to 14 in 1931. However, there is still room for further reduction and, furthermore, it will continue to take much attention and hard work even to keep the record at the low point reached in 1931.

Eye accidents have diminished in line with all other types of accidents, constituting 10.5 per cent. of the latter in 1926 and 6.6 per cent. of the latter in 1931. In 1926 the average eye accident serious enough to cause a loss of time incapacitated the victim for 9.6 days; in 1931 the average eye accident caused a loss of 25.7 days.

The 14 cases occurring in 1931 caused a loss of 361 days' time in addition to six permanent partial disabilities. Five eyes were lost and one other accident involved an estimated 10-per cent. impairment of vision in one eye.

A few years ago the packing departments were believed to provide the lion's share of eye hazards, particularly because of the frequency with which packing-machine operators suffered from "shots" of hot cement issuing through undetected holes in cloth sacks. Our last year's record shows that the packing department has not, as yet, redeemed itself. The 14 accidents suffered were distributed as follows:

Place of Occurrence	Accidents	Days Lost
Quarry	2	21
Clay field	–	—
Crushing department	–	—
Raw-grinding department	1	2
Burning department	1	86
Finish-grinding department	1	2
Coal-grinding department	1	18
Cement-storage department	–	—
Packing and shipping department	2	98
Power-plant	3	90
Shops	2	32
Railroad	–	—
Yard	1	12
Others	–	—
Totals	14	361

It will be readily observed from these figures that the greatest relative severity of these accidents came from the packing and shipping, power-plant, and burning departments in the order named. The packing and shipping department, for example, contributed 27 per cent. of the total days lost.

It is my personal opinion that the reduction in eye accidents in the cement industry and also the reduction of other kinds of accidents, can be attributed primarily to education and then to method. This is indicated by our personal experience with the eight plants which are operated by the Medusa Portland Cement Co., and this company has made some very good safety records. The eye-accident hazards of this company perhaps are typical for the cement industry as a whole.

There exists in the cement industry eye hazards that are more pronounced perhaps than in other industries. This is especially true in the packing and the shipping department, where the bursting of the container may cause the cement to fly out suddenly.

In our company we classify our eye accidents as follows: Miscellaneous, foreign body in the eye, cement in the eye, falling objects hitting the eye, emery where grindstone is being used, burns, electric failures, injury to the eyelids, acid.

Our experience has demonstrated that, after our employees have been made thoroughly acquainted with the dangers of eye accidents, and after goggles have been supplied to them and they have been compelled to use them, eye accidents are practically eliminated. We find this to be true in our own company and I am quite sure that it is the experience of other manufacturers in other industries.

We are quite certain that the only way to insure results in safety work is to eliminate careless and haphazard methods and to have a definite system of rules and enforcement.

National Portland to Buy Equipment Soon

The contract for the engineering and supervision of construction of the proposed cement plant of the National Portland Cement Co., at Brodhead, Pa., has been awarded to W. S. Barstow & Co., Inc., Reading, Pa. According to Malcolm Duncan, chief designing engineer, his firm does not expect to handle the major part of the construction work as this will probably be submitted as a general contract to some other firm. Plans for some of the miscellaneous buildings are already completed and construction of these will begin as soon as the weather allows. No definite information is as yet available as to when the construction of the main plant units will begin, but it is expected that a decision on the plant equipment will be reached within a few weeks.

Construction of New Lime Plant Under Way

The Louisiana Lime Products, Co., which was organized recently by Warren G. Gray of Alexandria, La., and others, has begun work on its new line plant at Easton, near Oakdale, La. This unit will cost about $35,000 with equipment, and additional units are expected to be added later. A 2-mi. right-of-way for railroad connection is also being cleared. J. H. McDonald is superintendent of the plant.

10-Per Cent. Dividend; Reëlects Management

The Corydon Crushed Stone & Lime Co., Corydon, Ind., which recently declared a dividend of 10 per cent., at its annual stockholders' meeting reelected all its officers. These are Will J. Bulleit, president; Ed S. Bulleit, vice-president; and Chas. A. Keller, secretary and treasurer.

Eighteen tons per hour from a No. 19 Crusher—100% through three-eighth inch opening using less than fifteen horsepower

THE following is the result of a test on a No. 19 Kennedy Ball Bearing Gearless Crusher.

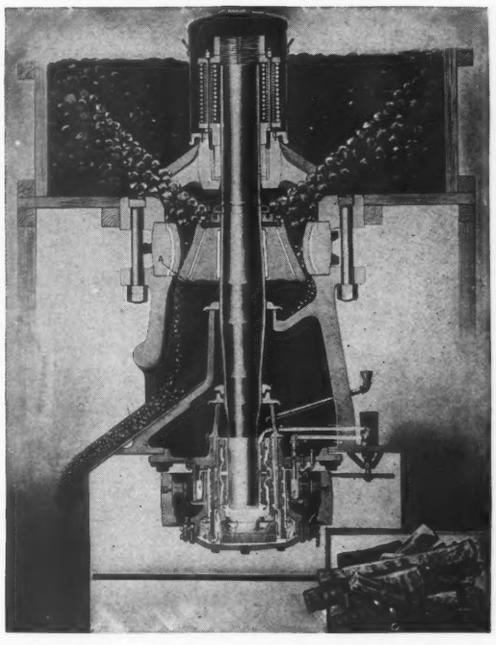
Exceedingly hard glacial gravel, 1½" and plus ⅝", was crushed for sand for concrete purposes, and less than fifteen horsepower was used.

The same crusher can be opened up and 1½" stone can be produced at a rate of from 30 to 50 tons per hour.

With the opening set to ⅛" on the closed side the following results were obtained:

Minus ⅜"	100 %
Plus 3 mesh	21½%
Minus 3—Plus 4	17 %
Minus 4—Plus 14	36½%
Minus 14—Plus 48	15 %
Minus 48—Plus 100	4 %
Minus 100	5½%

This was crushed at the rate of 18 tons per hour.



Built in various sizes with receiving openings from 1¾" to 14". Produces sizes from ⅛" to 3", with capacities up to 620 tons per hour on the larger sizes.

The Kennedy Ball Bearing Gearless Gyratory Crusher is guaranteed to do more crushing, size for size, of any given material, with less power consumption, than any crusher ever built. 90% Of the power input to motor is applied direct to breaking the rock between head and concaves. The head and shaft of the type "S" crusher is suspended on springs to permit tramp steel to pass through. The ball-and-socket eccentric is self-aligning. This crusher may be operated by a synchronous motor, built in the pulley of the crusher, or by belt from standard motor. This crusher takes one-half the power required for a geared crusher, and saves 80% in the cost of maintenance.

We manufacture a complete line of primary jaw and gyratory crushers, ball mills, rod mills, screening, elevating, and conveying equipment, etc. Complete information describing any or all of this machinery will be sent on request. *Send for latest information on our vibrating screen.*

KENNEDY-VAN SAUN MFG. and ENG. CORP.

Two Park Avenue **New York, N. Y.**

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Classified Buyers' Guide

A Directory of Pit and Quarry Advertisers Arranged According to Product

Although every effort is made to insure accuracy and completeness in these listings, the publisher cannot accept responsibility for errors or omissions. Any mistakes discovered will gladly be rectified, if brought to the attention of the Advertisers' Service Department.

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Eagle Iron Works

Agitators, Thickeners and Slurry Mixers
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Traylor Eng. & Mfg. Co.

Air-Filters
American Blower Corp.

Air Separators
Bradley Pulverizer Co.
Gay, Rubert M.
Gruendler Crusher and Pulverizer Co.
Universal Road Machinery Co.

Ash and Refuse-Handling Equipment
Allen Sherman Hoff Co.
Haiss Mfg. Co., Geo.
Robins Conveying Belt Co.

Asphalt
Standard Oil Co. (Indiana)

Backfillers
Austin-Western Road Mchy. Co.

Balls (Grinding)
Kennedy-Van Saun Mfg. and Eng. Corp.

Balls (Tube-Mill, etc.)
Kennedy-Van Saun Mfg. and Eng. Corp.
Fried. Krupp Grusonwerk A.-G.

Bearings (Anti-Friction)
Robins Conveying Belt Co.
S K F Industries, Inc.
Sprout, Waldron & Co.

Bearings (Ball)
S K F Industries, Inc.

Bearings (Roller)
S K F Industries, Inc.

Belt Drives
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Belt Fasteners
Flexible Steel Lacing Co.

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Manheim Mfg. & Belting Co.
Robins Conveying Belt Co.
Sprout, Waldron & Co.
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Sprout, Waldron & Co.
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Bins (Steel)
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Blast-Hole Drills (See Drills—Blast-Hole)

Blasting Supplies
Ensign-Bickford Co.

Bodies (Motor Truck, Concrete Mixing)
Jaeger Machine Co.

Blowers
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Blocks (Sheave)
Sauerman Bros., Inc.
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Borings, Core
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Sprague and Henwood Inc.

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National Wire Cloth Co.

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Sprout, Waldron & Co.
Welch Engineering Service, F. M.

Cars (Quarry and Gravel Pit)
Austin-Western Road Mchy. Co.

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Castings
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Eagle Iron Works
Kennedy-Van Saun Mfg. and Eng. Corp.
McLanahan and Stone Corp.
Robins Conveying Belt Co.
Sprout, Waldron & Co.

Cement Pumps (See Pumps; Air Pumps; Pumps, Cement Slurry; Pumps, Bulk Cement)

Central Concrete-Mixing Plants (Complete)
Sprout, Waldron & Co.

Chain Drives
Chain Belt Co.

Chain (Elevating and Conveying)
Chain Belt Co.
Cross Engineering Co.
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Chutes and Chute Liners
Cross Engineering Co.
Goodyear Tire & Rubber Co., Inc.
Hendrick Mfg. Co.
McLanahan and Stone Corp.
Morrow Mfg. Co.
Robins Conveying Belt Co.
Sprout, Waldron & Co.

Clamshell Buckets (See Buckets—Clamshell, Orange-peel, etc.)

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Bradley Pulverizer Co.
Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machine Co.

Clips (Wire Rope)
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Clutches
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Coal-Pulverizing Equipment
Bradley Pulverizer Co.
Gay, Rubert M.
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Deister Concentrator Co.

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Smith Engineering Works

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Conveyor Idlers and Rolls
Chain Belt Co.
Robins Conveying Belt Co.

Conveyors and Elevators
Allen Sherman Hoff Co.
Cross Engineering Co.
Gruendler Crusher and Pulverizer Co.
Haiss Mfg. Co., Geo.
Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machinery Co.
McLanahan and Stone Corp.
Morrow Mfg. Co.
Robins Conveying Belt Co.
Smith Engineering Works
Sprout, Waldron & Co.
Traylor Eng. & Mfg. Co.
Universal Road Machinery Co.
Welch Engineering Service, F. M.

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Jaeger Machine Co.
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Cranes (Crawler and Locomotive)
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Bay City Shovels, Inc.
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Crusher Parts
American Pulverizer Co.
Kennedy-Van Saun Mfg. and Eng. Corp.
McLanahan and Stone Corp.

Crushers (Cone)
Nordberg Mfg. Co.

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Gruendler Crusher and Pulverizer Co.
Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machinery Co.
Nordberg Mfg. Co.
Smith Engineering Works
Traylor Eng. & Mfg. Co.
Universal Road Machy. Co.

Crushers (Ring)
American Pulverizer Co.

Crushers (Roll)
American Pulverizer Co.
Austin-Western Road Mchy. Co.
Gruendler Crusher and Pulverizer Co.
Kennedy-Van Saun Mfg. and Eng. Corp.
McLanahan and Stone Corp.
Robins Conveying Belt Co.

They're FASTER . . .

. . . that's why JAEGER TRUCK MIXERS Get the Jobs!

Patented "Dual-Mixing" action—Patented faster discharge—Dual control levers—1-man combination swiveling hopper-head and chute—Faster accurate water tank—Quick acting discharge door—these Jaeger features mean more trips per day, more profit.

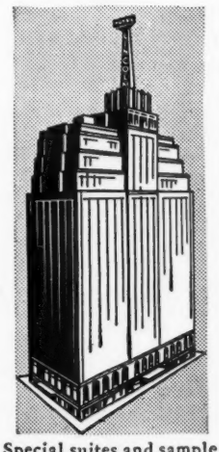
1 Man Spout Saves Minutes on Every Trip

Write for new 1933 prices, 1 to 5 yd. sizes.

THE JAEGER MACHINE CO.
602 Dublin Avenue Columbus, Ohio

IN THE HEART OF NEW YORK

TO STAY AT THE LINCOLN . . . IS A HAPPY REMEMBRANCE



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Conveniently accessible to railroad terminals, steamship piers, the business and shopping centers . .

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ROOM *with* PRIVATE BATH, RADIO *and* SERVIDOR

$3 *single per day* **$4** *double per day*

Special weekly and monthly rates.

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44th to 45th Sts.—8th Ave.—New York

UNDER NEW MANAGEMENT "A RELIANCE HOTEL"

THE BRADLEY AIR CLASSIFIER

and the

BRADLEY HERCULES MILL

Operating in conjunction with the Tube Mill make possible either open circuit or closed circuit, or a combination of the two on the primary and secondary reduction stages.

Operated in Closed Circuit with the Tube Mill, the Bradley Air Classifier Insures

Maximum Capacity

Absolute Uniformity of Product

Any Degree of Fineness

Within the Range of Commercial Operation

Recent improvements to the BRADLEY AIR CLASSIFIER have materially increased its efficiency and emphasize its leadership in the field of Air Separation

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Etablissements Fernand Poitte, Paris

Classified Buyers' Guide

A Directory of PIT AND QUARRY Advertisers Arranged According to Product

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Drills, Diamond
Pennsylvania Drilling Co.
Sprague and Henwood Inc.

Drills (Rock)
Loomis Machine Co.

Drills (Well) (See Drills—Blast-Hole)

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Fried. Krupp Grusonwerk A.-G.
Lewistown Fdry. & Mach. Co.
McLanahan and Stone Corp.
Traylor Eng. & Mfg. Co.

Dust Arrestors
American Blower Corp.

Dust-Collecting Systems
Allen Sherman Hoff Co.
American Blower Corp.

Dust Handling Systems (Hydro Vacuum)
Allen Sherman Hoff Co.

Dust Hoods and Helmets
Pulmosan Safety Equipment Co.

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Elevators (See Conveyors and Elevators)

Eliminators (Soft Stone)
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Robins Conveying Belt Co.
Sprout, Waldron & Co.
Welch Engineering Service, F. M.

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Nordberg Mfg. Co.

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Allen Sherman Hoff Co.

Fuses (Detonating)
Ensign-Bickford Co.

Gaskets
Goodyear Tire & Rubber Co., Inc.

Gasoline
Standard Oil Co. (Indiana)

Gasoline Engines (See Engines—Internal-Combustion)

Gates (Bin) (See Bin Gates)

Gates (Clamshell)
Haiss Mfg. Co., Geo.

Gears and Pinions
Chain Belt Co.
Haiss Mfg. Co., Geo.
Sprout, Waldron & Co.

Gears (Herringbone)
Chain Belt Co.
Sprout, Waldron & Co.

Gelatin (See Explosives)

Generators (See Motors and Generators)

Glass Sand Equipment
Lewistown Foundry & Machine Co.

Goggles
Pulmosan Safety Equipment Co.

Grab Buckets (See Buckets—Clamshell, Orange-Peel, etc.)

Grating (Steel)
Hendrick Mfg. Co.

Greases
Standard Oil Co. (Indiana)

Grinding Balls (See Balls, Grinding)

Grizzlies
Eagle Iron Works
Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Fdy. & Mach. Co.
Robins Conveying Belt Co.
Smith Engineering Works
Traylor Eng. & Mfg. Co.
Universal Road Machy. Co.

Guards (Wire)
National Wire Cloth Co.

Guns (Hydraulic)
Georgia Iron Works

Hammer Mills (See Crushers—Hammer)

Hoists
McLanahan and Stone Corp.
Sauerman Bros., Inc.
Smith Engineering Works
Sprout, Waldron & Co.

Hoppers
Hendrick Mfg. Co.

Hose (Air, Steam and Water)
Goodyear Tire & Rubber Co., Inc.

Hose Couplings (See Couplings)

Hydraulic Guns (See Guns—Hydraulic)

Idlers
Chain Belt Co.
Robins Conveying Belt Co.
Smith Engineering Works
Sprout, Waldron & Co.

Kilns and Coolers (Rotary)
Kennedy-Van Saun Mfg. and Eng. Corp.
Fried. Krupp Grusonwerk A.-G.
Traylor Eng. & Mfg. Co.

Lime Kilns
Kennedy-Van Saun Mfg. and Eng. Corp.
Fried. Krupp Grusonwerk A.-G.

Lime-Handling Equipment
Robins Conveying Belt Co.

Linings (Ball- and Tube-Mill)
(See Mill Liners and Linings)

Loaders and Unloaders
Haiss Mfg. Co., Geo.
Robins Conveying Belt Co.
Sprout, Waldron & Co.

Locomotives (Electric, Gas and Steam)
Lima Locomotive Works

Lubricants
Standard Oil Co. (Indiana)

Magnetic Pulleys See Pulleys, Magnetic

Mill Liners and Linings
Kennedy-Van Saun Mfg. and Eng. Corp.

Mills (Grinding) (See also Crushers—Hammer)
American Pulverizer Co.
Bradley Pulverizer Co.
Kennedy-Van Saun Mfg. and Eng. Corp.
Fried. Krupp Grusonwerk A.-G.
Lewistown Fdy. & Mach. Co.
Sprout, Waldron & Co.
Traylor Eng. & Mfg. Co.

Motors (Internal-Combustion)
(See Engines — Internal-Combustion)

Motor Trucks
General Motors Truck Co.

Nozzles (Hydraulic) (See Guns—Hydraulic)

Oils (Graphite)
Standard Oil Co. (Indiana)

Oils (Motor)
Standard Oil Co. (Indiana)

Packing
Goodyear Tire & Rubber Co., Inc.

Partitions (Wire)
National Wire Cloth Co.

Perforated Metal Plates
Chicago Perforating Co.
Cross Engineering Co.
Hendrick Mfg. Co.
Morrow Mfg. Co.
Sprout, Waldron & Co.

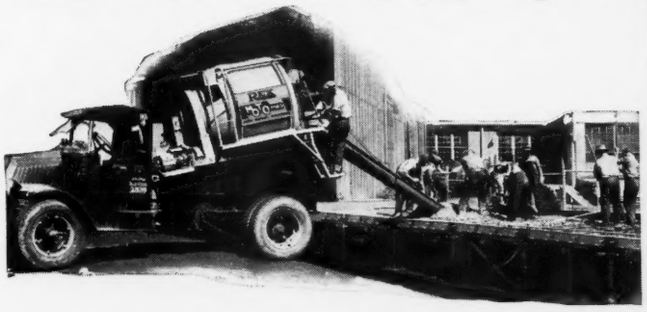
Pipe Flanges
Georgia Iron Works

Plug Valves (See Valves)

Pneumatic Drills (See Drills, Rock)

Portable Conveyors
Haiss Mfg. Co., Geo.
Robins Conveying Belt Co.
Sprout, Waldron & Co.

Often . . the REX JACKASS HOIST and One-Man Jiffy Spout



Mean the Margin Needed to Get the Job . . . in these Days of "Close Figuring"

Time—Time—Time—in any stage of construction, the man that saves time saves money—money needed to provide the margin that represents the difference between profit and loss. Often, the Rex Jackass Hoist and One-Man Jiffy Spout provide the Central Mixing Plant with the margin needed to meet competitive prices—and get the contractor's business.

Nobody Loses . . .

And the contractor saves money too. For with the Rex Jackass Hoist and One-Man Jiffy Spout, the concrete is spouted over an area 75% greater than possible with the flat discharge and can be discharged more accurately—just as wanted.

Investigate these two features—patented by the Chain Belt Company and found on the Rex exclusively—Get them now—don't wish you had them later for "close figuring." To the many features of the Rex—they add these great advantages that cannot be obtained elsewhere.

The Jackass Hoist—Raises the mixer discharge 8 feet, increasing spouting area 75%—often cutting the cost of concrete in the forms 25% to 50% or more in eliminating ramps and wheeling.

The One-Man Jiffy Spout—Saves 2 to 5 minutes on every spouting job. On the road, it replaces one fender at no increase in weight—on the job it swings on hinges: a one-man, 15-second job.

Without the Jackass Hoist and the Jiffy Spout, you have something less than your money will buy in Moto-Mixers. Address:

CHAIN BELT COMPANY, MILWAUKEE, WIS.
1646 W. Bruce Street ▪ Cable Address: Beltchain

REX MOTO-MIXERS
Reg. U.S. Pat. Office

REX MOTO-MIXERS AND AGITATORS ▪ JOB MIXERS
PLANT MIXERS ▪ AGGREGATE ELEVATORS ▪ CEMENT ELEVATORS ▪ CEMENT UNLOADERS ▪ BELT CONVEYORS

MIXERS: 1 YD. 1½ YD. 2 YD. 3 YD. 4 YD. 5 YD.
AGITATORS: 1½ YD. 2 YD. 3 YD. 4½ YD. 6 YD. 7 YD.

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Getting 24 Tons of Material Per Day from One Kiln

"ONE SIROCCO COLLECTOR went into service at Howes Cave," writes a prominent engineer. "So far it is wonderfully successful, getting 24 tons of material per day from one kiln . . . The gases from the Collector appear to be practically pure fog and the snow adjacent to the plant is pure white, a condition which has not prevailed since the waste heat boilers were started."

An Invitation to Engineers

To describe to you the possibilities of the Sirocco Collector for each particular problem of material separation (the collection of material from air or gases) is impossible. We therefore urge engineers and executives interested in material separation to correspond with us regarding tests in our laboratory. Every problem of this type can be tested in a most thorough manner and reliable data can be compiled to show the results that can reasonably be expected of a Sirocco Collector installed in your plant. Write direct to the factory or call at any American Blower Branch Office. No obligation.

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CANADIAN SIROCCO CO., LIMITED, WINDSOR, ONTARIO
BRANCH OFFICES IN ALL PRINCIPAL CITIES

American Blower
"Sirocco" VENTILATING, HEATING, AIR CONDITIONING, DRYING, MECHANICAL DRAFT
MANUFACTURERS OF ALL TYPES OF AIR HANDLING EQUIPMENT SINCE 1881

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Please send more data on the Sirocco Collector.

*Name*_____
*Firm Name*_____
*Address*_____ *City and State*_____ (1252)

Classified Buyers' Guide

A Directory of PIT AND QUARRY Advertisers Arranged According to Product

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Portable Crushing and Screening Plants
Austin-Western Road Mchy. Co.

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Portable Loaders (See Loaders and Unloaders)

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Sprout, Waldron & Co.

Pulleys (Wing)
Sprout, Waldron & Co.

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Kennedy-Van Saun Mfg. and Eng. Corp.
Universal Road Machinery Co.

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Bradley Pulverizer Co.
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Fried. Krupp Grusonwerk A.-G.
Lewistown Foundry & Machinery Co.

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Morris Machine Works

Pumps (Centrifugal)
Allen Sherman Hoff Co.
Chain Belt Co.
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Georgia Iron Works
Morris Machine Works

Pumps (Dredging)
Allen Sherman Hoff Co.
Erie Pump and Engine Works
Georgia Iron Works
Morris Machine Works

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Erie Pump and Engine Works
Georgia Iron Works
Morris Machine Works

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Smith Engineering Works

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Smith Engineering Works
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Deister Machine Co.
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Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machinery Co.
McLanahan and Stone Corp.
Morrow Mfg. Co.
National Wire Cloth Co.
Robins Conveying Belt Co.
Smith Engineering Works
Sprout, Waldron & Co.
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Universal Road Machinery Co.
Welch Engineering Service, F. M.

Screens (Vibrating or Shaking)
Austin-Western Road Mchy. Co.
Deister Concentrator Co.
Deister Machine Co.
Gay, Rubert M.
Gruendler Crusher and Pulverizer Co.
Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machinery Co.
McLanahan and Stone Corp.
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Sprout, Waldron & Co.
Universal Road Machinery Co.

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Gruendler Crusher and Pulverizer Co.
Haiss Mfg. Co., Geo.
McLanahan and Stone Corp.
Sprout, Waldron & Co.

Shovels (Electric, Internal Combustion and Steam)
Austin-Western Road Mchy. Co.
Bay City Shovels, Inc.
Ohio Power Shovel Co.

Silos
Chain Belt Co.

Skip Hoists and Skips
Chain Belt Co.
Robins Conveying Belt Co.
Welch Engineering Service, F. M.

Solvents (Carbon)
Standard Oil Co. (Indiana)

Speed Reduction Units
Chain Belt Co.

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Sprout, Waldron & Co.

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Chain Belt Co.

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Hendrick Mfg. Co.
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Sauerman Bros., Inc.

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Allen Sherman Hoff Co.

Tanks
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General Motors Truck Co.

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Transmission Machinery
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Gruendler Crusher and Pulverizer Co.

Trippers
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Robins Conveying Belt Co.

Truck Cranes (See Cranes)

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Jaeger Machine Co.

Trucks and Trailers (See Motor Trucks)

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Tube Mills (See Mills—Ball, Tube, etc.)

Unloaders (Box Car)
Chain Belt Co.

Valves (Pump)
Manheim Mfg. & Belting Co.

Variable Speed Reducers or Transmissions
Chain Belt Co.

Vibrating Screen Plate
Chicago Perforating Co.
Cross Engineering Co.
Hendrick Mfg. Co.
Morrow Mfg. Co.

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Washers (Sand, Gravel, and Stone)
Eagle Iron Works
Haiss Mfg. Co., Geo.
Kennedy-Van Saun Mfg. and Eng. Corp.
Lewistown Foundry & Machinery Co.
McLanahan and Stone Corp.
Smith Engineering Works
Traylor Eng. & Mfg. Co.
Universal Road Machinery Co.
Welch Engineering Service, F. M.

Well Drills (See Drills—Well)

Wheels (Car)
Eagle Iron Works

Winches and Capstans
Chain Belt Co.
Robins Conveying Belt Co.
Sprout, Waldron & Co.

Wire Cloth
National Wire Cloth Co.
Robins Conveying Belt Co.

Wire Rope
American Cable Co.
Leschen & Sons Rope Co., A.
Williamsport Wire Rope Co.

Wire-Rope Fittings
American Cable Co.
Leschen & Sons Rope Co., A.
Williamsport Wire Rope Co.

Wire Rope Slings
American Cable Co.
Leschen & Sons Rope Co., A.
Williamsport Wire Rope Co.

Worm Gears (See Gears and Pinions)

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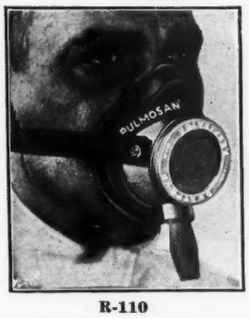
Patented



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Dustpruf Respirator

Most popular for protection against fine dusts. Weight, 2½ oz. Comfortable, adjustable, easy breathing.

. . . that keep down your accident figures!

PULMOSAN RESPIRATORS
Protection Against
Dusts, Smoke or Fumes

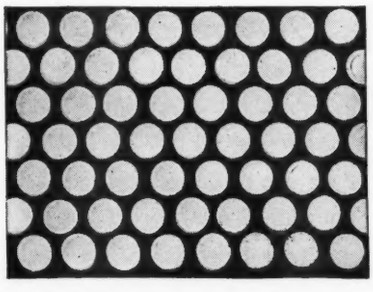
Safety Goggles
Non-Shatterable
All Kinds

Everything for
Industrial Safety

Write for Safety literature and prices

Pulmosan Safety Equipment Corp.
176 Johnson St., Brooklyn, N. Y.

MORROW SCREEN PLATES



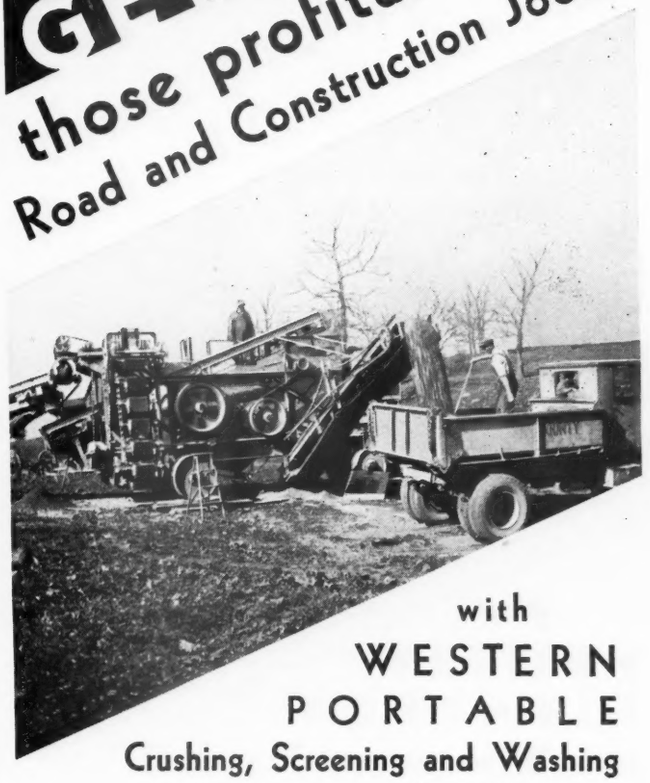
MORROW PERFORATED METAL SCREEN PLATES for sizing and preparing coal, sand, gravel, stone and other bulk materials are made by a Company specializing in screening machinery.

A complete set of punches and dies covering a wide range of sizes, in round, square, oval and diagonal slots are ready for the press, insuring prompt delivery of orders.

Prices are right.
Send for Bulletin 57.

The Morrow Manufacturing Co.
Wellston, Ohio

GET those profitable Road and Construction Jobs!



with
WESTERN
PORTABLE
Crushing, Screening and Washing
PLANTS

Why let transportation cost and difficulties keep you from securing aggregate supply contracts on road building and construction jobs?

Commercial producers have approved WESTERN PORTABLE PLANTS as an absolute necessity under today's conditions, to supplement their stationary plants.

You can tow a WESTERN PORTABLE Crusher and Screener or a WESTERN PORTABLE Washer to any location by truck and quickly set up to produce a high quality product.

WESTERN CRUSHING AND SCREENING PLANTS

The No. 100 Plant, shown above, delivers either a graded or mixed delivery directly to trucks. Such features as: anti-friction bearings throughout and overlapping type bucket loading conveyor; assure a uniform high-grade product.

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These plants make possible the utilization of conveniently located stone and gravel to provide up to 1000 cubic yards daily of accurately screened and completely washed aggregate. The conveyor, 3-deck screen, three screws, power unit, and all piping and sluicing arrangements are mounted on a single trailer.

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The Austin-Western ROAD MACHINERY CO.

ROLLERS, CRUSHING & SCREENING PLANTS, SCARIFIERS, MOTOR GRADERS, PLOWS & SCRAPERS, BITUMINOUS PLANTS & SPRINKLERS, ROAD GRADERS, ELEVATING GRADERS, DRAGS, SHOVELS & CRANES, DUMP WAGONS

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400 NORTH : CHIGAN AVE., CHICAGO, ILL.
Branches in principal cities.

Please send me complete information about WESTERN Crushing, Screening and Washing Plants, including the New Sales Plan.

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City .....
State .....

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PERFORATED METALS

and particularly the Heat-Treated, Double-Corrugated Plate are popular in the quarry field. They wear well.
Full range of sizes.

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ELEVATOR BUCKETS

Are made to fit. That's the first requisite. Any size or style made. No order too small or too large.

Investigate the Weston Testing Screen for making sizing tests.

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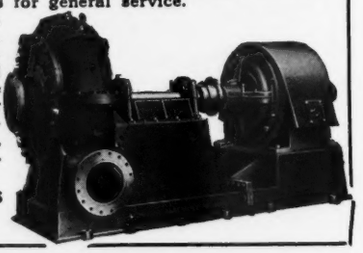
CENTRIFUGAL PUMPS

For hydraulic dredging, filling, sand and gravel production, hydraulic conveying of slurry and other liquids containing abrasive materials, clear water pumps for general service.
Also complete dredges with all accessory equipment. Dredging pump designs include heavy duty types and special alloy parts for severe service. Types and sizes for the largest or smallest operations, and belt, motor, steam, oil or gasoline-engine drive.



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Export Office: 50 Church Street, New York

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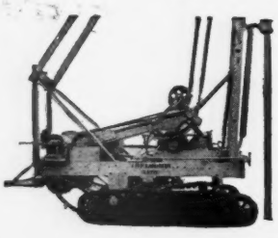


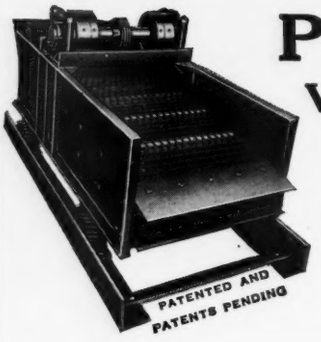
The New Loomis "Clipper" size 44 answers the question with friction clutch operated full length crawlers—simple, durable, accessible. It will climb unusually steep grades and will pay for itself in time saving (which can be devoted to drilling) getting to the jobs that are hard to reach and quick shifting to positions.

Size 44 "Clipper" comes equipped with steel frame, wooden or steel mast, wire or manila line.

Write for full information.

Established 1842

THE LOOMIS MACHINE CO. 15 E. Market Street TIFFIN, OHIO



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VIBRATING SCREEN

Built in all standard sizes and in either single, double or triple deck. Write for Bulletin No. 21.

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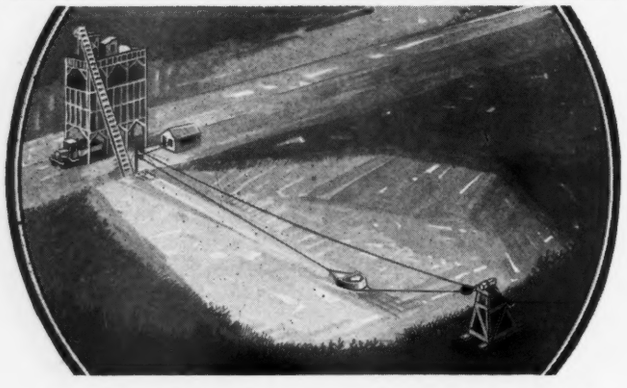

"By far the most economical machine for digging and conveying gravel," declare the great host of users of

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Under present conditions, the small sizes of Crescent Scrapers operated in conjunction with portable or semi-portable screening plants are particularly good money-makers, assuring a liberal return on a relatively small investment.

Prices of Sauerman equipment are on rock bottom, so now is the time to act. Write for Pamphlet No. 16.

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Designing modern gravel plants and modernizing old plants.

Increasing capacities and reducing production costs.

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We specialize in all kinds of scrubbing problems involving CRUSHED STONE or GRAVEL.

The ALLSWEDE SCRUBBER positively removes mud and clay balls from stone and gravel and materially reduces soft stone content.

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This Won't Happen To Your Buckets

Do the rivets on your belts pull out? Have your operations been held up because of repairs necessary when a bucket goes "haywire"? Do your elevator belts soon look like a jig-saw puzzle?

That's unnecessary.

VEELOS Balata Belting is tough. It will hold. When rubber tears and wears out VEELOS is just starting its long term of satisfactory service.

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Manheim, Pa.

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Manheim, Penna.

Without obligation please send me further details and samples of your Veelos Balata Belting.

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Spiral Screw and Log Washers, De-Waterers and Shale Removers, Flume Classifiers, Swintek Ladder Suction Screen Nozzles, Chain Type Cutters, Barges and Pontoons, A Frame and Gantry Hardware, Vibrating and Revolving Screens, Steel Dump Cars, Grizzlies, Car Wheels and Trucks, Steel Bins, Water Tanks, Structural Towers, and Dry Pans.

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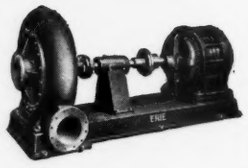
Machinists — Founders
DES MOINES, IOWA

ERIE SINCE 1889
GOOD PUMPS

FOR ECONOMICAL SAND AND GRAVEL PRODUCTION



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CAPACITY, SCREENING EFFICIENCY and ECONOMY — Backed by Our GUARANTEES and the SATISFACTION of 2000 Installations

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Perforated Metals — Screens of All Kinds — For Sand, Gravel, Stone, Etc.

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PROMPT SHIPMENT

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Tel. Canal 1459 CHICAGO, ILL.

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CRUSHERS—Double roll and Sledge Wedge Crushers, for practically any product. Capacities to 1000 tons an hour.
SUPER DRY PANS—For especially large tonnages.
WASHERS AND SCRUBBERS — Steel log Washers; scrubbers, cylinder washers, sand drags and washing screens.
DRYERS—Revolving cylindrical, of various sizes.
JIGS—For concentrating and beneficiating hematite and manganese ores.
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McLanahan & Stone Corp.
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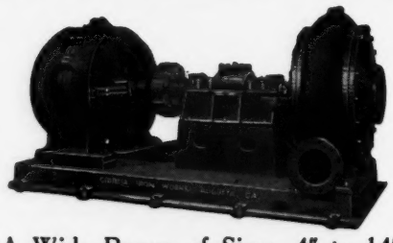

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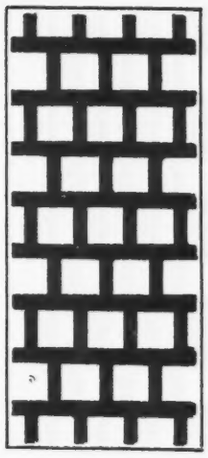

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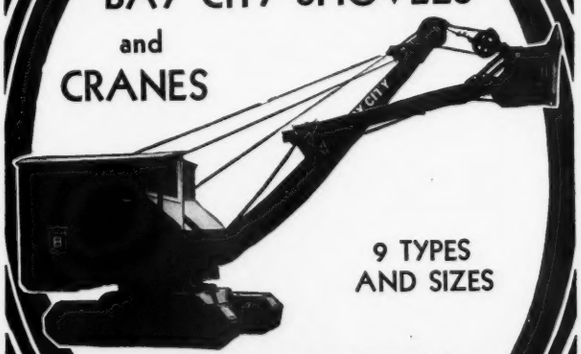

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- ☐Castings, Steel
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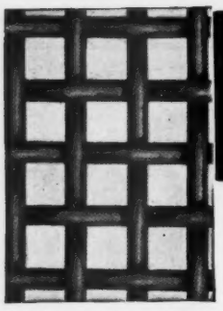

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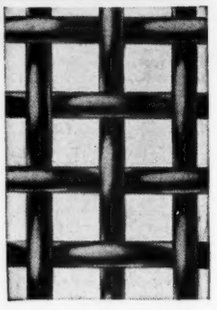

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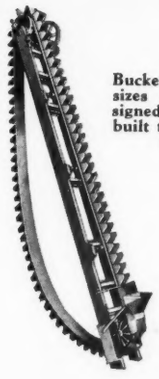

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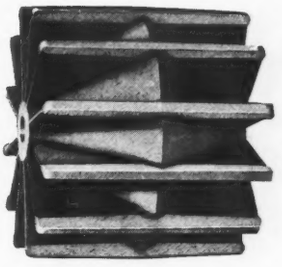

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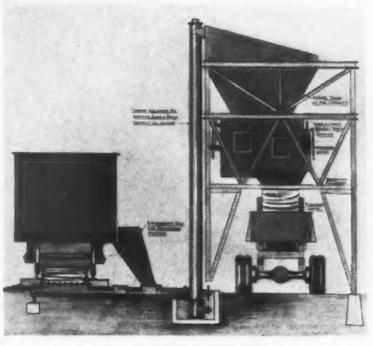

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